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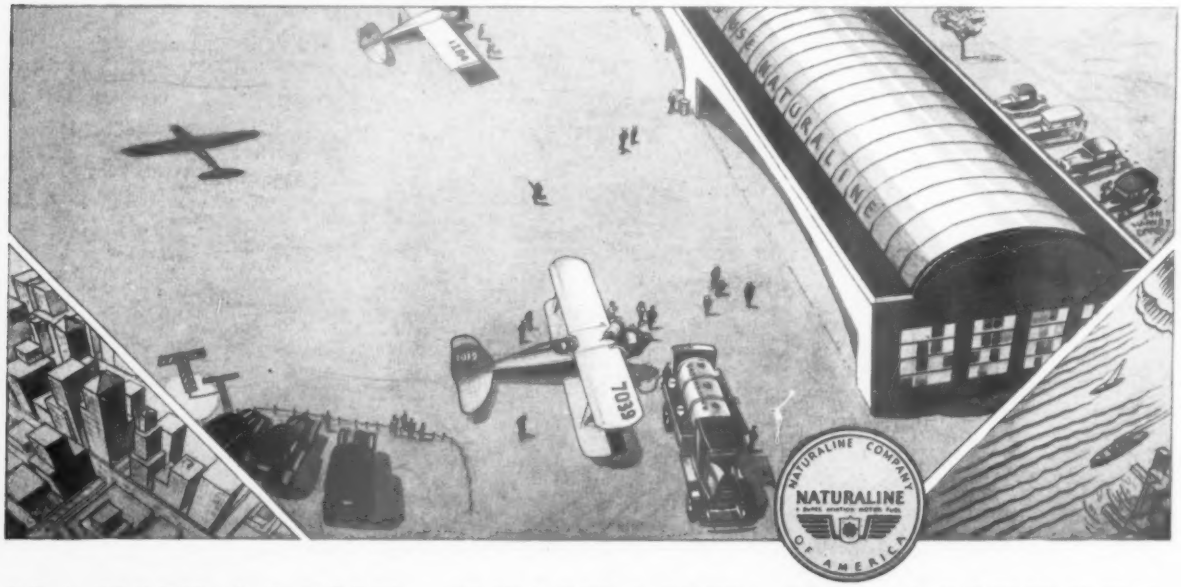

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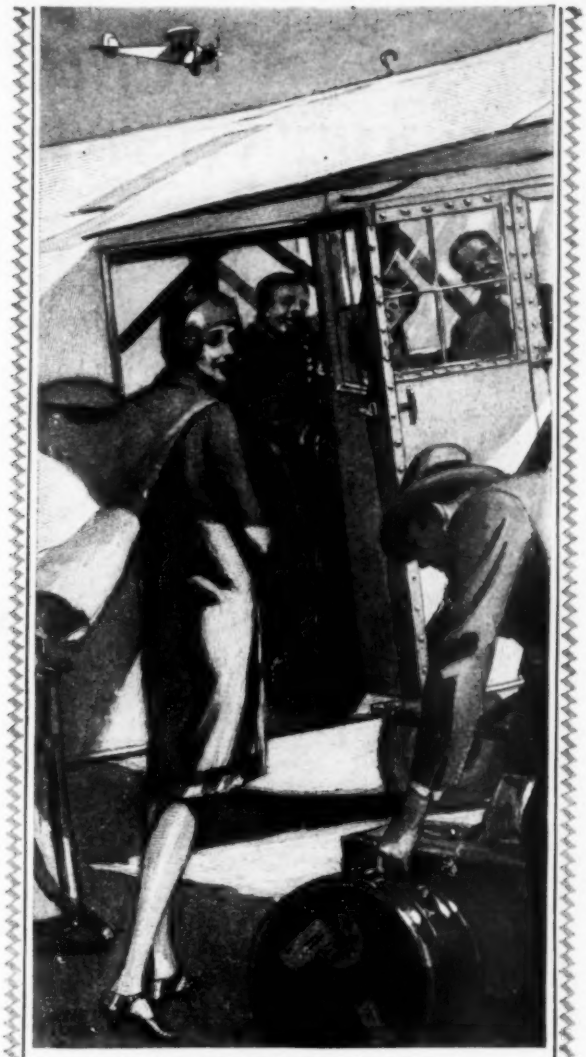

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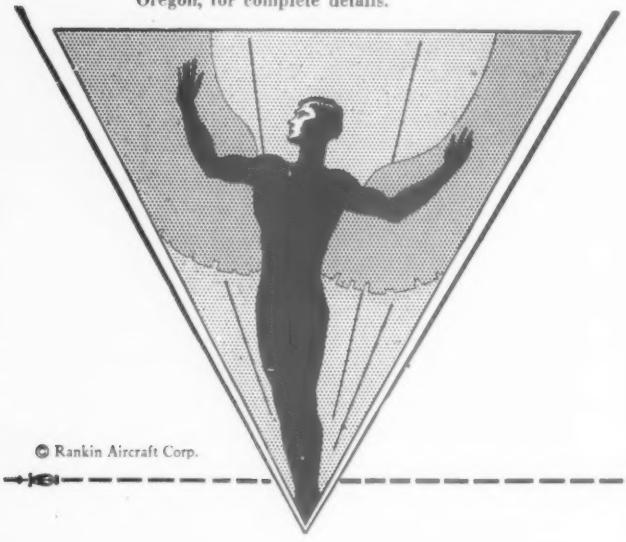

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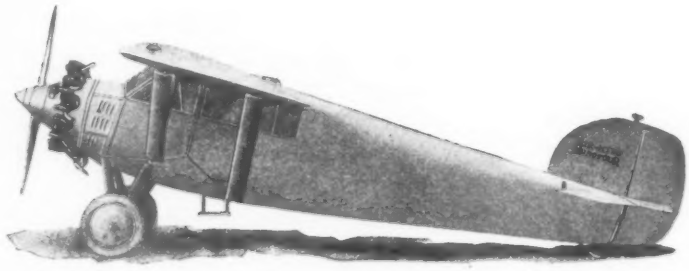

NATIONAL AIRWAYS SYSTEM

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Popular Aviation

Published Monthly

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Commander Richard E. Byrd

Commander Byrd is setting forth on his third great aerial adventure, this time across the unmapped wastes of the Antarctic. We join with the great host of his friends in wishing him the success that months of the most careful preparation should insure. Godspeed all the gallant men who accompany Richard Byrd, scientist, adventurer, officer and gentleman.

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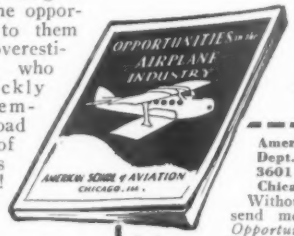

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Political—Maybe

THERE seems to be a difference of opinion as to what constitutes the main issue during the present Presidential campaign. But out of the welter of main issues and side issues dragged in by both sides we have so far failed to find a reference to aviation and its growing importance, both as a means of transportation and communication and as a means of national defense.

Those of us who are interested would like to know the attitude of the two major parties on this question. What do they propose to do? Does either plan the establishment of a new cabinet officer, Secretary of the Air, or some such title? Is the policy of present federal control to be continued or are we to have this control handed back to the states with the probable result that the air traffic laws will soon be in the same state of chaos as the laws governing automobile traffic?

There can easily be two minds on the question of aviation where it touches national defense. Aviation is too new for much precedent to be established. However, we do know one thing, and that is that during the later stages of the world war the British War Cabinet found it essential to set up a separate Air Ministry. The necessities of war compelled this step which was almost immediately justified by the results obtained. The proper co-ordination was finally effected, where before there had been jealousies and competition.

Lord Thomson in "Air Facts and Problems" has the following pertinent things to say:

"Co-operation between the fighting services is more difficult in peace than in war. . . . The problem of co-operation with the new arm would appear to be everywhere the same, and the arguments based on British experience may be of general application. . . . Co-operation does not involve encroachment by any one of the services on the functions of the others. Many sailors, soldiers and over-eager airmen are apt to think that co-operation implies subordination and that one arm must be supreme. Co-ordination is of course essential, but subordination is not compatible with effective strategical co-operation between naval, military and air forces."

Another Englishman of great experience, Admiral Kerr, makes the natural division in his book, "Land, Sea and Air." Kerr is under no delusions, he has been attached to all three arms of the Service and knows both peace and war time difficulties.

Three branches of national defense—all co-ordinated under one head, advised by a staff which knows both the capabilities and limitations of each branch—that should be the goal. If we must have it in event of war, why not have it during peace so that its very existence may, in itself, make armed aggression more remote?

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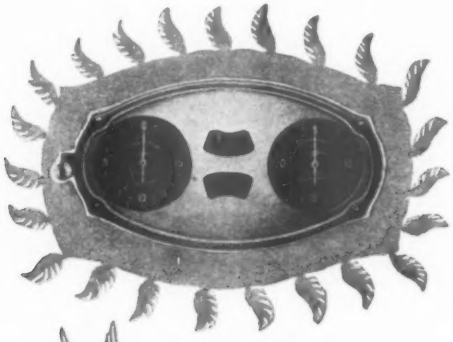

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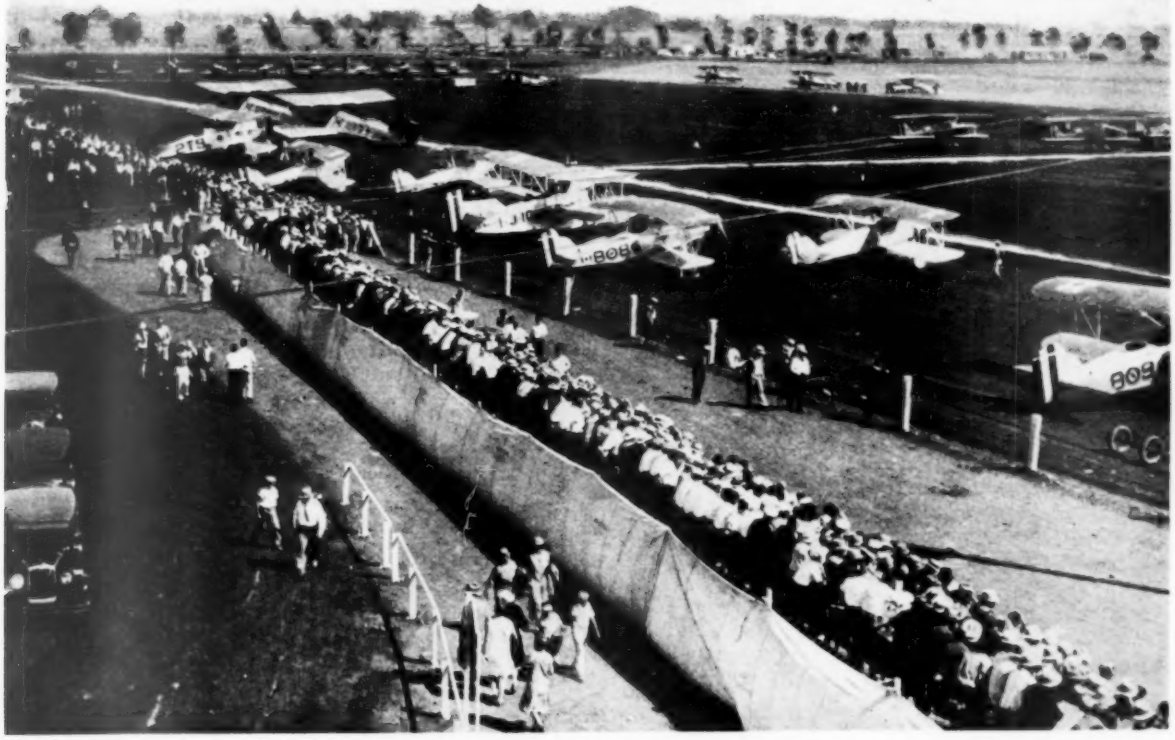
The National Air Races



THE National Air Races and Aeronautical Exposition of 1928, were held by the California Air Race Association at Mines Field, Los Angeles, September 8-16, 1928, under the sanction of the National Aeronautical Association.

With $150,000 in cash prizes and $25,000 worth of handsome silver trophies to lure them, 250 civilian, Army and Navy pilots entered the various competitions that included three transcontinental races for Class A, B and C ships, one non-stop transcontinental race, one international race for Canadian flyers, two California cross-country races for Classes A and B, seven closed course events for civilians, ten for Army, Navy and Marine pilots, a dead stick landing contest, a parachute precision jumping event and two boys' model plane competitions.

During the nine days of the meet 700,000 persons witnessed the air manoeuvers and contests. The planes at Mines Field numbered 761. Of these, 461 were participants, including 161 Navy and 125 Army ships.

The participating planes carried 1,000 pilots, mechanics and passengers, aggregated 7,000 hours flying time with a mileage approximating one million miles, involving 5,000 take-offs and landings in practically every American type of plane, powered by almost every type of motor.

"I have never seen such flying," declared Colonel Charles A Lindbergh, who came to look and remained to fly as a substitute for Lieutenant J. J. Williams, of the Army stunt trio, the only fatality of the meet.

In fifty-eight days the officials of the California Air Races Association transformed a mile square barley field into an up-to-the-minute airport with three runways 7,000 feet long, an exposition building of 200,000 square feet, grandstand and bleachers seating 23,000 and parking lanes for 37,000 automobiles.

The transcontinental class races wrote a new epic of progress in man's conquest of the air. Out of forty-nine starters, in the A, B, and C classes forty finished. These planes started from Roosevelt Field, New York City, and followed a course set by the race committee that took them through Pennsylvania, Ohio, Indiana, Missouri, Kansas, Oklahoma, Texas, New Mexico and Arizona to California with thirty minute control stops at various cities for refueling and specified night controls, entirely eliminating night flying.

Class A, for ships with motors of 510 cubic inch displacement or less, open to all types of stock model planes primarily designed for commercial flying and having a capacity of at least one passenger besides pilot, raced for $10,000 capital prize money, divided between the first six pilots who finished in the shortest elapsed time. Sixteen 30 minute controls and five night stops were designated for this class with an average distance of 173 miles between controls. Lap prizes, totalling $2,560, were offered by various control cities.

There were 38 entries, of whom 25 started September 5 and 23 finished September 10.

Earl Rowland, piloting a Cessna-A with Warner "Scarab" motor, won

every lap all across the continent and finished first with an elapsed flying time of 27 hours, 31 seconds, averaging 108.85 M. P. H. He was awarded the first prize of $5,000 and garnered an additional $1,510, a wrist watch and a Mexican serape as lap prizes.

Robert Dake and Theodore Taney were second in an American Moth with Warner "Scarab" motor, capturing the second class prize of $2,500 and $750 lap money. Time 28-18-43.

W. H. Emery, Jr., in a Travel Air, Warner "Scarab" motor, won third prize of $1,000 and $275 lap money. Time 28-48-28.

T. W. Kenyon, in a Challenger, Warner motor, won fourth prize of $700. Time 29-19-47.

Tex Rankin, in Waco 10, 0x5 motor, won fifth place and $500 in 29-36-29.

James S. Charles, in an Eagle Rock (Curtiss 0x5), was sixth in 30-48-5, winning $300.

Despite the handicap of bad flying weather, fog, rain and storms in the East and stiff head winds in the West, these small, light planes made an excellent record of steady, consistent performance and speed. Only 12 out of 25 finished last year, and this year's winner, with a 110 H. P. Cessna, made the 2,939 miles in only five hours more flying time than it took Art Goebel to make it over a more direct course in his 440 H. P. Yankee Doodle Lockheed Vega. All the rest, but one, of the Class A planes landed within twenty minutes of the winner, demonstrating the remarkable progress made in a year, the reliability of the small plane and the safety of flying when conducted under conservative methods.

The Class B Transcontinental race was for standard stock model civilian planes powered with motors of more than 500 cubic inch displacement but not to exceed 800 cubic inches. The ships started two days after Class A, September 8, and finished September 12. They followed practically the same course as Class A, with thirteen thirty minute controls, averaging 209 miles apart and four night stops.

The pilots contended for $15,000 and $2,410 lap money. There were 22 entries, 20 starters and 14 crossed the finish line.

John Livingston won this race in a Waco 10, powered by a Wright Whirlwind motor, entered by the Advance Aircraft Company. His elapsed time was 22 hours, 56 minutes, 59 seconds, averaging 128.03 miles per hour. He captured the first prize of $7,000, lap prizes totalling $1,410, a wrist watch and Mexican serape and a special sweepstake award of $2,500 for the shortest elapsed time in any of the transcontinental races, a grand total of $10,910 for his four days' flying.

E. E. Ballough won second place in a Laird LC-R, with "Whirlwind" motor, with an elapsed time of 23-16-24. He got the second prize of $3,500, lap money amounting to $450, and the second sweepstakes prize of $1,500.

Allen H. Lockheed congratulates Robert Cantwell at the finish of the Class C Transcontinental race.

John P. Wood, winner of the National Air Tour this year, was third in a Waco ship, with Whirlwind motor. His elapsed time was 24-31-8. His prizes totalled $2,525.

Edward G. Schultz, Cessna, Whirlwind, was fourth. Time 24-55-08. Prize money, $1,300.

Charles W. Meyers, Waco 10, Whirlwind, fifth. Time 25-04-13. Prize $700.

L. F. Schoenair, Buhl Airsedan, Whirlwind, sixth. Time 26-11-20. Prize $300.

Others who finished were Jay Sodowsky, Cessna B., Wright J5, time 26-57-53; Ive McKinney, Pacer, Whirlwind, time 27-47-05; M. W. Whittall, Fairchild, Whirlwind, time 37-05-16; Maurice Marrs, Travel Air, 29-47-13; B. H. Shaw, Lockheed Vega, 31-42-04; R. J. Merritt, Ryan, Whirlwind, 33-59-32; T. A. Wells, Travel Air, D4000, Wright J5, 26-12-01.

Livingston with his Waco 10 won every lap all across the continent. He was closely pressed on the first two laps by J. W. Smith and Al Litzenberger in a Cessna until they were forced to drop out of the race, leaving Schultz in a Cessna the only close contender until Ballough flew his Laird LC-R into second place between Kansas City and Wichita and held that position till the end of the race. Ballough flew a plucky race. He was rapidly cutting down Livingston's time lead when he began to have motor trouble in Oklahoma and had to put in a new cylinder and new valves. In Yuma he was forced to put in a new motor, larger than the old one, making it impossible to use the cowling and causing consequent loss of speed.

Transcontinental Class C race from New York to Los Angeles for civilian ships powered with motors of more than 800 cubic inch displacement brought out a number of fine, large cabin ships, designed to carry at least four passengers and pilot. They started three hours after the Class B ships and followed very nearly the same course with nine half hour controls and only three night stops. Each ship was obliged to carry a load of 640 pounds in addition to the pilot. There were four starters and three finished.

The winner was Robert W. Cantwell in a Lockheed Vega monoplane, powered with a P&W "Wasp" motor. His elapsed time was 24 hrs., 9 min., 01 sec., an average of 121.69 miles per hour. He carried as passengers Edward Schlee, round-the-world flyer, Erle P. Halliburton, owner and navigator of the plane, and the lat-

John H. Livingston, pilot, and M. B. Allen, passenger, winners of the Class B Derby.

ter's brother, John Halliburton.

Captain C. B. Collyer, holder of the present around-the-world flying record of twenty-three days, was second in a Fairchild Cabin monoplane, with Wasp motor, time 27-10-45.

Edward J. Brooks, in a Fokker Special Universal monoplane, with Wasp motor, finished third in 27-24-53.

Cantwell won every lap of the race, capturing first prize of $5,000 and $1,155 lap money, in addition to the wrist watch given by Pecos, Texas, and the Mexican serape presented by El Paso.

Collyer won $2,675 prize and lap money and Brooks $1,650.

The one big disappointment of this great national event was the failure of the Transcontinental non-stop race that was fully expected to set a new East-West continental record. Open to all civilian ships powered with any type motor of unlimited cubic inch displacement, prizes totalling $22,500 in cash and several exceedingly handsome trophies were offered.

Nine large, powerful ships, piloted by famous air skippers, started from Roosevelt Field, New York City, on Wednesday, September 12, expecting to arrive in Los Angeles the next afternoon, but only one of them, Art Goebel and his Yankee Doodle, succeeded in getting through and was disqualified under the rules for making a forced landing for gas in Arizona. All of the others were forced down by motor troubles or lack of gas at various points across the continent. Most of the ships encountered a windstorm area as they approached the Rockies that later developed into cyclonic fury in the Middle West and so reduced their speed that gas supplies were exhausted.

The Army, Navy and Marine Corps contributed generously to the success of the meeting. The Army sent large squadrons of pursuit, observation and bombing planes from Crissy Field, San Francisco; March Field, Riverside; Rockwell Field, San Diego; Crockett Field, Texas, and nine big tri-motor Keystone bombers across the continent from Langley Field, Virginia.

From the Navy came the famous VB2B squadron of 15 Curtiss Hawks, squadrons of Boeing fighters and bombers from North Island, San Diego; pursuit groups from the airship carriers Langley, Lexington and Saratoga lying in San Diego and San Pedro harbors and Marine Corps squadrons of Curtiss Falcons and Curtiss OC2 ships from Mather Field.

Every day the sky over Los Angeles was filled with great formations, sometimes numbering 150 of these warriors of the skies flying between Mines Field and their bases. The contingents from San Diego and the big fleet carriers left their bases 130 miles distant each day, flew to the field, did their stuff and returned home without landing, all in a few hours.

The "Three Sea Hawks" of the Navy, Lieutenants Tomlinson, W. V. Davis, Art Goebel's Dole flight navigator, and Storres "stole" the show. Their amazing manoeuvres and antics in the air were instructive, beautiful and hair-raising and kept the spectators at a fever pitch

H. S. Myrhes, winner of Class A race from San Francisco to Los Angeles.

Dudley M. Steele, chairman of contest committee, greets Earl Rowland, winner in Class A Derby.

of excitement. They left the ground in their little Boeing fighters in close formation as if nailed together, not more than a few inches seemingly separating the wing tips of their planes. They zoomed, looped, dived at furious speed, turned over and flew upside down, never losing their perfect formation. They did startling climbing rolls, corkscrewed down for a series of slow, deliberate loops fifty feet above the ground and closed the performance with their famous following loops in which they chase one another in perfect verticle circles, one at the top of the loop while the second is diving down ahead of him and the third coming up behind.

The "Three Musketeers" of the Army were equalling daring, skillful and sensational. This stunt trio was composed of Lieutenants J. J. Williams, I. A. Woodring and W. L. Cornelius. The thrilling climax of their act was a dangerous outside loop performed by two of the trio that started at a height of 5,000 feet and brought them diving down at terrific speed to about 1,000 feet above ground, when they turned for the upward climb and leveled off just before the completion of the loop to avoid disobeying a service regulation which forbids this exceedingly dangerous manoeuvre.

It was during this performance on Monday, September 10, third day of the show that Lieutenant Williams, their leader, suffered his fatal crash. While his companions were climbing for altitude Williams flew back and forth before the grandstands enter-

taining with a series of daring stunts, looping, rolling, diving and turning over on his back.

Woodring and Cornelius had just completed their outside loop dive and were leveling off when Williams started his last stunt flying upside down in front of the stands, barely 100 feet above the ground. As he finished the feat and turned over to come out of it in a vertical bank his engine popped and failed to pick up quick enough to prevent crashing. He was badly injured and died seven hours later.

The next day Colonel Lindbergh, who had been attending the show merely as a spectator, walked into the field headquarters of Captain A. W. Brock, chief operations office of the Army unit, and volunteered to fill the gap in the Three Musketeers and fly with Woodring and Cornelius, who were his buddies during his Army training. He was given Williams' place and thereafter during the rest of the show flew as Number One of the trio, leading them in all their daring aerial stunts.

The only other casulty of the meet was the accident of Lieutenant George H. Hasselman, U. S. N., who crashed while making a vertical bank too low around a pylon in the sixty mile race of the fifteen VB2B squadron of Boeing fighters. While badly injured Lt. Hasselman is recovering.

William H. E. Drury, youthful pilot of London, Ont., flying a Waco, won the international race from Windsor, Canada, in 19 hrs., 55 min., 41 sec., averaging 107.63 miles per hour. The distance was 2,145 miles

Robert Dake checking in his American Moth at Kansas City during the Class A Derby.

with five controls. Drury won first prize of $5,000, $750 lap prizes, a Stetson hat, a watch and two pairs of chaparajos. Kenneth Whyte, of Hamilton, Ont., in a Moth, won second prize of $2,500, $150 lap money, a traveling bag and sweater. S. T. Stanton and E. V. Hemple, flying a Martin bi-plane, were forced down by engine trouble almost within sight of their destination, at Fontana, forty miles from Los Angeles.

The numerous closed course races were splendidly staged and furnished an almost continuous daily performance of speed and thrills. Thanks to the vast dimensions of Mines Field and skill of pilots as many as twenty racing craft were whirling around the pylons at a time at 100 to 170 miles an hour without interfering or clashing with each other or the stunt and exhibiton formations going on simultaneously.

The races followed triangular five and ten mile courses around huge checkered pylons so arranged that they were never out of sight of the spectators who followed every move of the speeding ships with the keenest interest.

The first closed course event was a forty mile civilian relay race for two place planes. The Eaglerock team, composed of Jack Frye, Capt., and J. S. Charles, Lee Flannigan, Paul Richter, Jr., and Harvey Bolton, won at 79.748 M.P.H. The Swallow team was second, and an individual, Louis E. Derryberry, was third. Closed Course Event No. 2 was a civilian race over a 50 mile course for plane flying engines in the 510 cubic inch class, and was flown with two preliminary heats and a final. Earl Rowland came in first in the final, in a Cessna, powered with a Warner motor, at 111.74. H. S. Myrhes in a Kinner-powered Simplex was second, and Robert Dake, flying an American Moth with a Warner motor was third.

The closed course event No. 3, a civilian free for all over a distance of 50 miles, limited to motors in the 720 cu. in. class, was won by D. C. Warren in a Travel Air equipped with a Hispano motor. Reginald Sinclair was second, in an Eaglerock powered with a Curtiss C-6, and Theodore Taney was third, in an American Moth (Warner). Warren's speed was 123.39 M.P.H. Closed Course Event No. 4, for civilians flying planes powered in 800 in. class, in a 75 mile free for all, was captured by E. E. Ballough in a Laird (Whirlwind), with John P. Wood second in a Whirlwind-equipped Waco, and John Livingston third, also in a Whirlwind Waco. The speed was 137.82 M.P.H.

Closed Course Event No. 5, a 100 mile civilian free for all speed and efficiency race for cabin planes powered with engines in the 800 cu. in. class, resulted in a speed victory for Louis G. Meister in a Buhl Airsedan, powered with a Wright Whirlwind, at 116.74 M.P.H. Victor Dalin, in a Bellanca, also equipped with a Whirlwind, took second place.

The efficiency contest was won by Victor Dalin in his Bellanca, with Louis G. Meister in the Buhl Airsedan second. The winner's effi-

E. Ballough of Chicago, who won the Class B Transcontinental Derby in a Laird biplane.

William Drury of London, Ontario, winner of International race from Windsor to Los Angeles.

ciency score was 629.493.

In Closed Course Event No. 6, an unlimited free for all speed and efficiency competition, over a course of 100 miles, Robert Cantwell flew home the winner in a Lockheed Vega powered with a Pratt and Whitney Wasp motor at a speed of 140.30 M.P.H. Art Goebel was second, also flying a Lockheed Vega Wasp-equipped, and L. F. Shoenhair, in a Whirlwind Buhl Airsedan, was third. Victor Dalin won the efficiency contest in his Whirlwind Bellanca. His point score was 863.232.

Closed Course Event No. 7 was a parachute jumping contest, run off in three competitions on three different days. A daily prize of $100 was offered to the contestant landing nearest the circle, and a final prize of $350 was given the jumper whose average accuracy in the three jumps was highest. George W. Wehling won with an average landing of 66 ft., 9 2/3 in. from the circle. Frank J. Garjola was second, and E. C. Lundquist was third.

Closed Course Event No. 8 was a 120 mile race open only to observation type military two-place planes. Lt. J. L. Kane won the race in a Vought Corsair, powered with a Pratt and Whitney Wasp motor. All of the other planes and motors, in the race were of the same make. Lt. H. C. Fick was second, and Lt. M. W. Ellis was third. The winning speed was 142.275 M.P.H.

Closed Course Event No. 9 was a Navy pursuit plane race over a 50 mile course. Lt. R. J. Crommelin won in an F-2-B1, powered with a Pratt and Whitney Wasp, at 147.77 M.P.H. All the planes and motors in this race also were of the same make. Lt. E. A. Cruise was second and Capt. Driscoll was third.

Event No. 10 was a closed course race for army pursuit planes over a distance of 50 miles. As in the other service races, all the entrants in this event were of the same make. Lt. W. L. Cornelius, flying a Curtiss Hawk with a Curtiss D-12 motor, won the race at a speed of 147.73 M.P.H. Lt. I. A. Woodring was barely 5 seconds behind, and Lt. J. E. Mallory came in third.

Closed Course Event No. 11 was a National Guard race for two place planes. All of the entrants were Douglas planes, powered with Liberty motors. Lt. Brooks was first in an O-2H at 124.88 M.P.H., Lt. D. F. Kearns in an O-2H was second, and Capt. Symons in an O-2C was third.

The best time of the meet was made in Closed Course Event No. 12, when Lt. T. P. Jeter, flying a new Boeing XF4B with a supercharged Wasp motor, won the free for all military pursuit race over 120 miles at 172.26 M.P.H. Lt. S. A. Cruise was second, and Lt. D. W. Harrigan was third.

Closed Course Event No. 14, open to National Guard, and Army and Navy Reserve primary training ships powered with 180 h.p. Hispano-Suiza motors over a 25 mile course, was won by Claude Owen at 93.82 M.P.H. T. Williams was second, and George Sherwood was third.

Event No. 15 was a light airplane speed and efficiency contest. The speed competition was won by E. H. Heath in his Heath monoplane with a Bristol Cherub engine, at a rate of

H. C. Lippiatt of Los Angeles, who came in first in Class B race from Oakland to Los Angeles.

112.00 M.P.H. Vern Roberts, flying a Velie powered Monocoupe was second, and Chas. A. LaJotte in a Velie Monocoupe was third.

In the efficiency contest John E. Carberry won with a Moth, powered with a Cirrus engine. Vern Robert's Velie Monocoupe was second, and E. B. Heath, in his Bristol Heath was third. The winner's score was 709.693. An added event, in which only Douglas planes powered with Liberty motors participated, was won by Lt. Barber at a speed of 127.49. Lt. Goss was second and Lt. Walthall was third.

The exposition held in connection with the races was a revelation of the extent, scope and diversity of the aviation industry. It made convincingly apparent that this infant of the commercial world, just out of its swaddling clothes, is already a business prodigy and fast becoming a giant.

The exposition building was a great stucco structure in mission style covering a city block and located just inside the main entrance to Mines Field with a spacious park-like patio between it and the rear of the grandstands. It provided 200,000 square feet of exhibition space for more than one hundred exhibitors with wide aisles and a high arched roof decorated with festooned bunting and flags of all nations.

The center of the floor was given over to the aircraft exhibits, while round the four sides were located the booths of motor and body builders, tool and instrument makers, tire and oil companies, steel and wood propeller manufacturers, parachutes, aviation toggery, schools, magazines, transportation companies and an array of accessories.

On the floor were grouped planes embracing nearly every size, make and type of airplane from a tiny one-passenger, two-cylinder, 20-H. P. grasshopper to the giant 1,600 H. P. Boeing passenger transport and huge Ford and Fokker tri-motored, 12 passenger cabin ships affording the luxuries of air travel.

Despite the intriguing and thrilling attractions of the flying field there was always a good crowd of intensely interested visitors in the exposition building and during the evening the aisles were packed.

(*Continued on page* 107)

Navy Pilot Charts

By George H. Dacy

The pantograph invented by the U. S. Navy and used in making pilot charts of upper air conditions.

FUTURE trans-Atlantic trips by air will be less hazardous and will be definitely planned as to charted course in advance of the flight as the result of important consummations of the Hydrographic Office of the U. S. Navy.

Monthly pilot charts of the upper air of the North Atlantic Ocean are now issued regularly by Uncle Sam. They are safe pathfinders for travel by air from the United States to Europe or from Old World to New. The U. S. Weather Bureau aids the Navy in this laudable activity by furnishing prerequisite meteorological data.

From the viewpoint of both amateur aviator and professional birdman, the spice of romance, technical conquest and scientific adventuring are interwoven in this victory of research over the secrets of the atmosphere over the sea.

The mere mention that for the first time in the history of aerial navigation such a chart has been developed to serve the needs of aeronautics is sufficient to intrigue your interest in this remarkable monthly "guide book" for flyers.

Former trans-Atlantic flights have been planned without such scientific assistance. They were dangerous "hit or miss" "cut and try" trips. Daring birdmen with the courage of modern Columbuses defied the perils of the unmapped atmosphere. Some sacrificed their lives but others guided by a kind fate triumphed in their conquests to score new victories for long distance flying. The charts now issued each month by our Navy provide vital data concerning the safest courses and the most favorable flying weather of the year for such journeys.

One just criticism of the North Atlantic upper air data previous to the issuance of the new naval charts was that most of the available information was so technical that none but a skilled meteorologist could translate it. Uncle Sam has eliminated this drawback by reducing the available facts and figures to a common language understood by every trained aviator.

A careful analysis and scientific study of all trans-Atlantic flights were made in the research preparatory to the publication of the first pilot charts of the upper air. The Navy Department is equipped ideally for such operations and is authorized by law to increase maritime security in every way possible. This authorization covers surface, subsurface and air investigations. Hydrographic engineers and aerial navigators working in cooperation with meteorological authorities of the U. S. Weather Bureau comprise the personnel entrusted with these responsiblities. The surveys of flights that succeeded as well as those that failed resulted in the production of the present pilot charts of the upper air, sterling contributions which will aid the advancement of aviation.

The pilot charts are designed primarily for the requirements of aerial navigators and are reduced to those units which are standard in the naval aviation service. Altitudes are recorded in feet, the same unit of measurement in which the altim-

eters on the seaplanes register. Distances are recorded in nautical miles to correspond to the readings of the air speed meters of the seaplanes. Wind velocities for all altitudes have been reduced from several other units to nautical miles per hour. Thus the navigator planning an air trip from one of these charts can combine distances, seaplane air speed and average wind velocity by the simple process of addition as a result of this standardization.

For the convenience of foreign nations who use the metric or other units, there is a special conversion scale on the side of the chart by which they can convert the U. S. Navy's pilot chart data into their own units. One of these scales combines nautical miles per hour, statute miles per hour and meters per second. Another combines inches, millibars and millimeters.

On the face of the chart, the average surface wind directions and velocities are indicated in nautical miles per hour for every five degrees of the ocean area. On account of the dearth of upper air data over the ocean areas, observations have been made at stations which surround the Atlantic Ocean including Mitchell Field, Lakehurst, New Jersey; Washington; Hamptom Roads; Due West, North Carolina; Paris Island; Pensacola; New Orleans; Groesbeck, Texas; Key West; Cocosolo, Canal Zone; Kingston, Jamaica; Santo Domingo, San Juan, Porto Rico; Teide, Canary Islands; Madrid and Barcelona, Spain, and Duindal and Dibelt, Holland. Many observations have also been recorded in mid-ocean from shipboard. Reports will be secured from many additional shore stations, islands, and research vessels for use on future maps.

Three chief flying altitudes are registered on the chart—2,500, 5,000 and 10,000 feet respectively — each elevation being identified by a different color so that the vagaries of altitude are discernible readily. By study of these charted statistics the aviator can determine at exactly what distance above the surface it is most desirable for him to fly at a certain time of year over a given course.

Curves showing the air temperatures for the month under discussion for the entire North Atlantic are prominent on the face of the map. Supplementary discussions explain how these temperatures affect the selection of safe aerial ocean routes. The Great Circle route from New York City to Europe followed by the 1927 trans-Atlantic flyers in December is unsafe because of prohibitive temperatures. Near Nova Scotia in Newfoundland, the average December temperatures fall below 30 degrees Fahrenheit while the actual day to day readings are even much lower. Successful long distance flights at those low temperatures are impossible.

It is possible, however, even during the month of December to fly from New York City to London. The route to be followed as indicated on the new Navy Department chart is safe but is considerably longer than the more direct summer air lane. This December route extends from New York City to Bermuda, a lap of 681 nautical miles. It has an average low temperature off New York City for the month of 40 degrees Fahrenheit with the thermometer reading rising rapidly in flying toward Bermuda. The average at Bermuda for December is 65 degrees. The second leg of this air trip is from Bermuda to the Azores, a distance of 1,790 nautical miles. The average temperatures over this stretch of the journey will approximate those near Bermuda. The last leg of the air voyage would cover 1,286 nautical miles from the Azores to Portland, England, not far from London. The temperature decreases over this route to an average minimum of about 45 degrees Fahrenheit at Portland.

Pilot balloon ready for release on a scientific flight.

Inflating one of the pilot balloons.

The effect of the ocean currents on air temperatures is illustrated aptly at Glasgow, Scotland. Although Glasgow is 1,000 miles north of Washington, D. C., it has the same average December temperature as the American Capital despite that this Scotch city is located in the latitude of Labrador. The temperature tempering influence of a warm ocean current effects this weather miracle.

The U. S. Navy through its Hydrographic Office secures monthly ocean temperature data from 3,800 international ships at sea which ply both the main-traveled and the more remote traffic lanes. These important data are of fundamental importance in the compilation and publication of the pilot charts of the upper air above the Atlantic—and other oceans of our spacious world's map.

The equatorial current is the source of fair winter weather in lands which it abuts, countries which without its moderating warmth would shake hands with greater annual frigidity. This ocean current drifting westerly up through the Caribbean Sea flows north and south of the West Indies, clockwise around the Mexican Gulf, northerly along the South Atlantic coast as the Gulf

Pilot charts are photographed preparatory to making zinc plates.

Stream and then northeasterly across the North Atlantic Ocean. It finally divides into various subcurrents which lap the African and European coasts and spread northeasterly along the British Isles, France and Portugal. These currents are of special interest to the modern birdman for they moderate winter flying weather in all the regions which they penetrate.

The mid-ocean circulation of salt water currents follows the general circulation of the over-lying atmosphere. The center of this circulation is the notable Sargasso Sea—a current eddy where there is practically no water movement. It is easily identified by the presence of surface seaweed crusting the calm ocean.

The effect of the Labrador and other cold Arctic currents which travel southward down the Atlantic coast inside the route of the Gulf Stream is depicted on the pilot chart by the congestion of the isotherms of both air and water between Cape Hatteras and Newfoundland. The number of foggy days in that vast fog belt is given. The most northerly air route to Europe from the United States logically is charted to the south of this zone of foggy weather.

In the charted discussion of air travel across the South Atlantic from Africa to Brazil as presented by the U. S. Navy, air temperature and fog data are generally absent as these factors are of little flying importance along such courses.

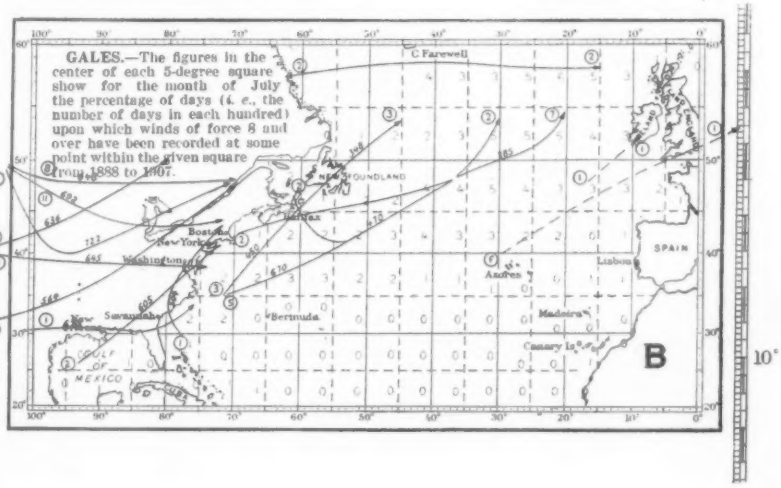
A number of interesting curves which can be studied in connection with the pilot chart for aviators are taken from official publications of the U. S. Weather Bureau and include diurnal variation in wind velocity at different altitudes. Differences at given points in the velocity of the wind at 8 a. m. and 3 p. m. are given as illustrations. One curve shows the amount the wind increases in nautical miles per hour from the surface to an altitude of 20,000 feet for North Atlantic, Middle Atlantic, East Gulf and West Gulf sections. A second curve illustrates what this variation amounts to in any particular surface direction. A fourth graph shows the angular change in the wind's direction with altitude. Yet another graph shows the reduction of temperature with increased altitude. All these diagrams are explained further in tabular form. Storm tracks for December are presented in the form of a ten-year average both over the land and ocean with the average daily rate of storm movement expressed in nautical miles.

The average barometric pressure of the Atlantic Ocean for December is presented graphically in a special insert chart. Another chartlet never previously published is found on the back of the pilot chart. In the production of this invaluable chartlet, the Hydrographic Office was assisted by radio experts of the Bureau of Engineering and Naval Communications. It shows the night and day receptive range of all stations in the area of the pilot chart which broadcast weather forecasts in synoptic form.

From this and similar charts, some of the problems of the world weather map—the ideal dream of all meteorologists—may be studied. As matters now stand, these weather broadcasts are in different codes. Potential adjustments and improvements are anticipated as the International Radio Conference which met in Washington recently has endorsed a universal code and a world organization in the dissemination of weather news through the ether.

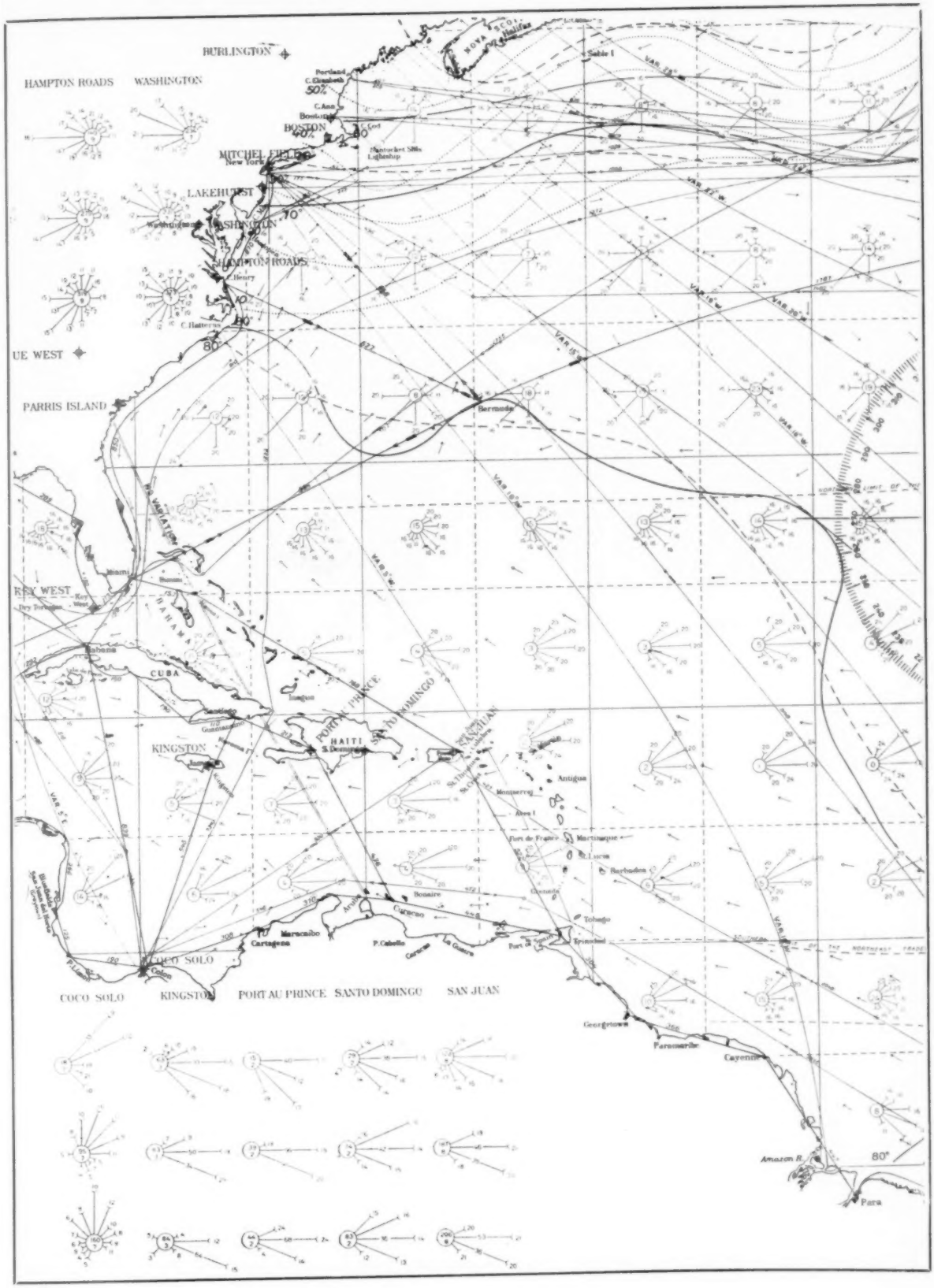
Under current circumstances if an aviator were to fly from Bermuda to the Azores and thence to Lisbon, the radio weather reports broadcasted within his range would include American, German and International codes as well as several others. Confusion, chaos and loss of time results from this unstandardized condition of synoptic weather broadcasts. The

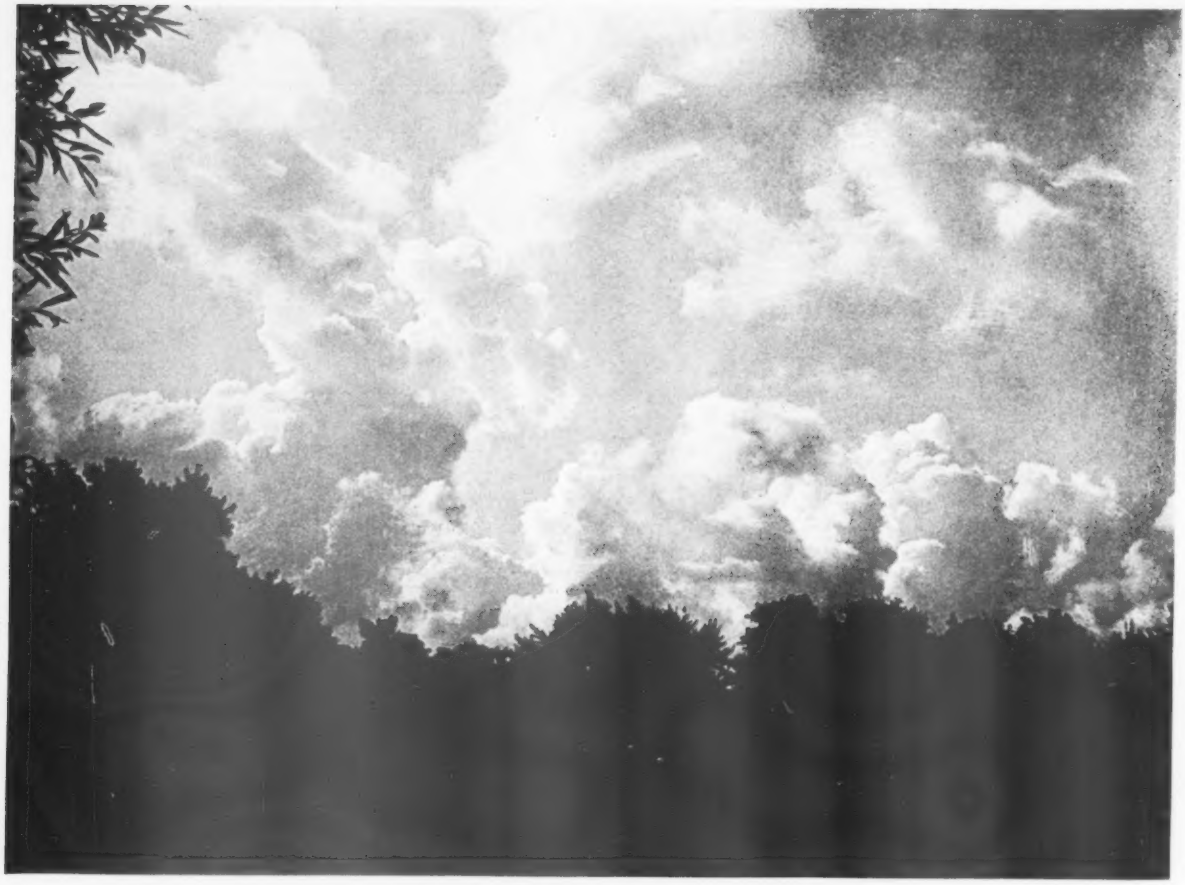
(*Continued on page* 121)


GALES.—The figures in the center of each 5-degree square show for the month of July the percentage of days (i. e., the number of days in each hundred) upon which winds of force 8 and over have been recorded at some point within the given square from 1888 to 1907.
C. Farewell
NEWFOUNDLAND
Boston
New York
Washington
Hatteras
Bermuda
Azores
Lisbon
SPAIN
Madeira
Canary Is.
GULF OF MEXICO
CUBA
B

One of the inset charts for estimating frequency of winds.

Section of Atlantic Upper Air Chart





These clouds reveal a battle of winds.

The Ways of the Winds

By M. Luckiesh

Director Lighting Research Laboratory, National Lamp Works of General Electric Company

TO most persons who think of winds at all, they are wild, uncontrolled spirits of the air, destroying but never preserving. Because they are always a part of terrifying and destructive storms, they have a bad reputation. But without winds we would have no weather, and without weather we would have a monotonous climate whose eternal sameness would make the earth uninhabitable. Winds mean change, and this is not only the spice of life, but it is everything to life. Therefore, if we are to have a place to live, we must have winds. Then it is the better part of wisdom to learn their ways in order to guard against their destructiveness and to utilize their favorableness.

Fog is always an enemy of aerial travelers. It never helps. It hinders and sometimes destroys. Winds can as often aid as hinder. Knowledge of them and of their ways greatly reduces their unfriendliness and ofttimes capitalizes them. With fog there is not even a chance for a truce. It is blinding, bewildering —a potential danger to be avoided. Winds may be good or bad, depending upon the viewpoint and upon knowledge.

The great aerial ocean near the bottom of which we now fly—or swim with stationary fins—is full of eddies and currents, great and small. Near the earth's surface there are many eddies, and on the average, the direction of the more defined currents is quite variable. However, as we ascend, the winds become less fickle, until at great heights—as viewed by the aerial traveler—the winds become quite constant in direction. Velocity is also another aspect which is intimately assoicated with fickleness. Near the earth's surface the average velocity is low, but as we ascend we find the winds become fresher, brisker, and finally, in the realm of cirrus clouds—five to eight miles high—they may be fifty, a hundred, and even two hundred miles per hour.

The wise flyer does not fly close to the earth where the eddies are most numerous—where the bumps are annoying. If the wind is against him, he does not fly high. However, if he desires to take advantage of a

steady wind, he goes as high as other factors dictate to his common sense and he enjoys a tail wind. Then he has the satisfied feeling of one who is swimming with the current in a river. The friction of the earth's surface—trees, buildings, hills and valleys—slows down the wind near the earth. These various objects deflect the wind and we have one cause of bumps.

With the exception of eddies or deflected currents of air, winds are always the result of temperature differences. Warm air is lighter than cool or cold air. Therefore, where air is heated we have a lowered pressure and air flows toward this low to equalize matters. As a consequence, we have a breeze, or a wind, or a hurricane—depending upon the magnitude of this difference in pressure.

Everyone has had enough first-hand experiences with winds to have learned that they are sometimes very powerful. However, it helps to know something of the forces involved. The weight of air upon each square foot of the earth's surface is approximately one ton. The weight of air above each square mile of the earth is approximately thirty million tons. On the entire earth the atmosphere weighs about six million billion tons. This apparently harmless, invisible fluid which we breathe and in which we are immersed is of great mass. Therefore, when a great quantity of it is in motion at a fair velocity, it has unsuspected powers to move objects.

If the earth's surface were smooth and of uniform composition, the general circulation of the atmosphere would be much simpler than it is. If the earth did not rotate upon its axis, the circulation would be still simpler. The air which rises over the heated equator has a relative velocity from west to east of about one thousand miles per hour, just as the points on the equator also have. As this air flows toward the poles to replace the air which flows from the poles to the equator at low altitudes, it gets ahead of the earth because of the decreasing distance of the earth's surface from the earth's axis. This adds a complication which is readily accounted for in a world-study of air-circulation.

The general circulation of the atmosphere is not of interest to most flyers. It is the local and immediate future which concerns most aerial travelers. However, some time in the future, when we travel the aerial highways from continent to continent, this will be of great interest. Then the general circulation of the atmosphere will be allowed for. It is possible that future air-liners may fly at high altitudes and for world travel they may fly only in one direction. Even though the general circulation of the atmosphere is not of direct interest now to those of us why fly or would fly, it aids us in understanding the ways of the winds.

If the reader will stick a pencil through an apple and will rotate it from west to east, he will see that the air which rises from the equator and flows toward the poles is deflected towards the right as it travels toward the north pole. This tendency toward the right adds one of the many influences which build up a pressure gradient from east to west, because the air tends to pile up on the right and diminish on the left. The equatorial current toward the poles descends as it leaves the equator and in the temperate zone becomes practically a surface wind.

The author, Mr. Luckiesh, has deprecatingly referred to his articles as "sugar-coated meteorology." We would say, rather, that Mr. Luckiesh has managed to put inspiration and beauty into what is otherwise a rather dry subject. Further, we can vouch for the accuracy of the scientific material he sets forth so attractively.

This accounts for the prevailing westerly winds in the United States. All of us know that the prevailing winds (with the exception of places where there are overpowering local disturbances) are from west to east. The influence of this prevalence is seen in the records of the New York-Chicago air mail. The average flying speed between these two cities for the period during which the records were taken was 86 miles per hour from east to west and 100 miles per hour from west to east. In other words, there was an average westerly wind equivalent at least to seven miles per hour. The average flying altitude was only 1,500 feet. If this had been higher, the difference in flying speed in the two directions would have been greater. It is seen that a knowledge of the ways of these winds is essential to the laying-out of schedules and to maintaining them.

However, this is an average month after month. From day to day the variation is much greater and consequently the effect of the wind upon the individual flyer is correspondingly varied and of increasing importance. If the flyer is to maintain the schedule, he must hug the earth in a high wind. With a tail wind he speeds along as care-free and as confident as the old mariners in the freshening trade winds of the tropical oceans. Those wind-jammers were engaged in trade and the notable stiff and steady winds became known as the trades. These winds have a large east to west component. In the higher latitudes of the tropics of the northern hemisphere, they generally blow from the northeast. These are the northeasterly trades. In the southern hemisphere they are southeasterly trades. As both these approach the equator, they become easterlies—flowing from east to west.

Calms are a joy to the flyer—if he cannot have a tail wind. But these were unpopular with the old mariners of the sailing ships. The doldrums near the equator are famous—or perhaps infamous. They are peculiar depressions or quiet areas between the trade winds of the two hemispheres.

The heated air, which rises from the equator to begin its journey toward the poles, changes in the northern hemisphere from an east wind near the equator to southeast, south, southwest and becomes nearly a west wind in the temperate zone. In the southern hemisphere the sequence is eastwind to northeast, north, northwest, and finally westerly. Even in this early infancy of world-travel by air the few adventurous flyers have all taken advantage of this knowledge. The northern Atlantic flyers have found west to east travel far easier than east to west. Those who have flown diagonally across the oceans of the northern hemisphere have had the prevailing winds on their tail as much as possible.

The antitrades are continuations of the trade winds overhead. The trade winds ascend as they near the equator and begin their journey to the poles, becoming westerlies in the temperate zones. They return, eventually, to the equator as trade winds and begin a new cycle of an endless series.

As already stated, winds are due to temperature differences. In the monsoon we have an example readily

understood. It is caused by seasonal differences in the temperatures of great areas of land and water. In the summer the land area becomes hotter than the ocean. The air rises from the land and is replaced by air from over the water. Thus we have a sea breeze.

In certain regions where the land is continually hotter than the water, we have continuous winds from sea to land. This is a monsoon. On our seacoast we may have the land hotter than the water only in the daytime in summer. Thus by ten o'clock in the morning we feel the welcome sea breeze. Sometime after sunset we may have a reversed breeze, although gentler. Along with the sea breezes comes moisture—water vapor. Thus it accumulates in the air to fall as rain. How true it is that winds make weather and without winds the earth would be a barren, parched desert devoid of a living thing. Then let us feel kindly toward winds, for we owe everything to them. In knowing their ways they become less dangerous.

The great clouds are being borne rapidly on the wings of the wind.

Another interesting air-current which is readily understood is the fall-wind. This has nothing to do with the season of that name. Its name arises from the fact that cold air being heavier than warm air, the former flows downhill. In mountainous country the cold air from the heights flows downhill. Where the country is more or less level, this flow from high altitudes is gentle. Such fall-winds in mountainous country and from glaciers attain considerable velocities, however; extremely noteworthy cases are found near the ice-caps of Greenland and the Antarctic continent. These winds attain very high velocities. Those from the antarctic ice-cap attain the terrific velocity of 150 miles per hour and their effect is noticeable more than 150 miles from the edge of that continent. Frosts in valleys are accountable by the drainage of cold air from the heights. Riding along in an automobile at night, we often note the chill of the air in the valleys, even though these depressions are slight.

The increase of wind velocity with altitude is extremely interesting to the flyer. At an altitude of one-half mile, the average velocity is approximately twelve miles per hour. This does not change much up to a mile high. At an altitude of two miles, the average velocity is about eighteen miles per hour. At three miles it is about twenty-six miles per hour. The average of the wind velocities at a height of six miles—the cirrus region of perpetual cold—is of the order of forty miles per hour. Anyone who has made a number of flights to altitudes of four or five miles, circling about over a flying field, becomes very conscious of the high velocities of the winds. In such a climb one is flying in one direction—against the wind—so much of the time that his slow climbing speed is comparable with the wind velocity. Therefore, he is flying predominantly in one direction.

The foregoing values are average ones. They include all the days of gentle breezes as well as those when winds are loosed. On the latter days the winds attain very much greater velocities than the average. In the cirrus region the winds sometimes attain velocities of 100 and even 200 miles per hour and these are maintained for days. Flying records will be made in those regions before long.

The types of windstorms have particularly attracted the attention of most persons. They are the tornadoes of the Mississippi valley and the hurricanes of Florida. The tornado is a mammoth whirlwind. We see it in miniature in the whirls of dust in summertime. However, like most storms it is not a danger to the flyer because of its low horizontal velocity. Thunderstorms, cyclonic storms, and tornadoes travel across the country at a velocity of about twenty miles per hour. Therefore, the superior speed of the airplane makes it possible to avoid them unless it is imperative to go on. Then the cyclonic storm, which extends over hundreds of miles, must be passed through or over. The thunderstorm is of much smaller area and may be avoided. If not, it may be necessary to climb several miles to pass over it safely.

About five o'clock one morning a terrific thunderstorm awoke the writer. As he closed the windows he thought of Landsdowne and the mighty dirigible which was flying somewhere to the south. In a few hours the terrible disaster was announced in the newspapers. It had taken place a hundred miles south. From the reports a line thunderstorm had passed across the country—great in length but not in width, for it passed over in a half-hour. Landsdowne could not pass around it owing to its extent, but was he wise in attempting to pass over it? A knowledge of the ways of the winds certainly told those who possessed it that boiling, seething, upward currents followed the line squall which, doubtless, was the advance guard of that assemblage of winds. Had dirigibles of such length and relative frailty been tested by upward currents of such force? These currents have upward velocities of twenty to thirty miles per hour. A long, rigid balloon, as it passed into it, received terrific shocks, stressing it seriously. Since that morning, the writer has often wondered what the opinions of the meteorologists really

(*Continued on page* 114)

World's Air Transport

This is a plain and frank criticism of air transport as at present constituted, taken from an article by K. Ruehl, in a recent number of the Zeitschrift des Vereins Deutscher Ingenieure. *It presents the views of an eminent German engineer and is interesting because it points out some of the obstacles that are being overcome both here and abroad.*

THE time has not yet arrived when millionaires are sprouting out of the air transport business in any country of the world. Excepting unusual times such as wars and other events of gigantic business consequences, it takes as a rule many years to make millionaires out of poor stock, that is, stock poor in worldly goods, but endowed with a sound aggressive mind. The railroads have produced their millionaires after years of hard pioneer work; and in those days the railway had no serious competitor for speedy means of transportation. Now we have the giant air transport organizations spanning the valleys and mountains of the country with invisible tracks along which persons, air mail and freight are hauled swiftly and with a high percentage of safety. Air transport, superior to all other means of transportation in speed of travel, would have been far more advanced, if it were not for this one obstacle, the lower economic advantage as compared to other means of transportation. That commercial aviation is constantly becoming more profitable to the operators, can not be doubted; if it were not a fact, why would the air transport organizations continue to exist and grow? Statistics gleaned from the operations in various countries and careful study by experts promise a continually expanding business and constantly increasing returns with ultimate exclusive self-support of the standard organizations operating airplanes for the handling of persons, air mail and freight.

Transport by air is still a comparatively small factor in modern business life, in view of the great technical achievements that have been made in the field of aviation. Particularly in the European countries, private capital has participated only to a small extent in the financing of air transport service, though the annually bettering business conditions of air transport service warrant a more extensive investment of private capital. During the first ten years of the development of the railways, for example, there were invested in them in England about $35,714,000, in Germany about $26,190,000 and in the United States as much as $73,809,000. Compared to these figures, the capital invested in the air transport companies of England, France and Germany is today not more than about $1,428,571, and including the cost of ground organizations and of erecting air ports, barely more than $6,000,000 to $7,142,000. In contrast to the amount of money expended in various countries for military aviation, the contributions thus far made to commercial air transport stand far in the background.

Although conditions are different today from those in the pioneer days of the railroad, these conditions in air transport prevail at a time when there is already in all leading business countries, which must deal with heavy traffic in transport, an urgent need for increasing the speed in the transport of man and commercial goods; and these conditions prevail also in spite of the fact that air transport organizations appear entirely able to satisfy the need for accelerated transport requirements.

The air transport service has two great advantages over other means of transportation: it operates above

both land and sea, and it maintains a high traveling speed, about 150 km. or 93 miles per hour as compared to 37 to 50 miles or 60 to 80 km. per hour of express trains in mountainous and level country. However, due to the frequently observed great distances of the airports from the business centers of a city, being as much as 16 km. or 10 miles, the saving in time effected by air transport is thus decreased. Considering this loss, the limit for express freight railway transport is about 250 km. or 155 miles and of passenger railway transport about 350 km. or 217 miles, after which distances the air transport service attains an increasing marked superiority over railway transport in respect to traveling speed. Air transport organizations would increase their usefulness and their business if their airports could be located within the business centers of the various cities. If we had to build Chicago over again, we would probably build it around a landing field having facilities for handling a thousand or more transport planes per day. Now it appears that a landing field will have to be built on the roofs of the skyscrapers of the Loop; unless the lake front in Grant Park soon becomes available. Similar conditions confront other cities in this country. But to maintrack again, for countries with undeveloped means of transportation, or for commercial routes passing repeatedly over land and sea, the distances at which air transport becomes superior to railway transport, may be much shorter; take for example, the transporting of products from an inland city across one of the Great Lakes; unless a railway barge were used, freight would have to be shipped around the lake or would have to be rehandled into and from a ship, whereas the airplane would take the crow's line.

The above advantages of the air transport are purchased, however, with two disadvantages: the airplane requires a great deal of motive power and it can handle but comparatively small loads. If all the freight now carried on freight trains should be hauled by airplane, the sky would be so thickened with flying men and their machines, that we would find it difficult to see the sun. We would need air traffic cops up in the sky and they would have to join the company of the Flying Dutchman instead of keeping their heels to the paving as is being done at State and Madison Streets, the crowded corner of Chicago's Loop.

For delivering one metric ton or about one gross ton of goods, the various means of transportation require the tractive power shown in Table 1, below.

In comparison to other means of transportation, the density of traffic in air transport can be but slight for this reason that the number of airplanes which can fly from one airport during a certain period is comparatively limited. Hence the airplane cannot be considered, under present operating conditions, as a means for wholesale transportation of freight and persons due to the technical limitations.

Today the expansion of the air transport system is still limited due to technical reasons, to the mainland and inland seas, as for example the Baltic Sea, the Mediterranean, the Great Lakes, etc. The flying range of today's airplanes does not permit the crossing of oceans with sufficient safety and larger useful loads. True enough, a number of times the Pacific and the Atlantic Ocean have been crossed successfully by airplane, but compared to the number of attempts that ended in failures, the successes have been rather few in number. The requirements for cross-ocean air travel can at the present be met only with the airship, if at all, for it can cover distances of several thousand km. with considerable useful load and without replenishing its fuel supply. Airplanes are more likely to be able to cross oceans if landing places are established along the route; but as yet no satisfactory and economically permissible scheme has been devised and carried out for this purpose thus far. In spite of all obstacles, the development of the air transport system has advanced sufficiently far in a number of countries to embrace comparatively large transport areas. The total length of the routes covered on schedule in various countries is shown in Table 2, below.

The regularity to schedule in air transport fluctuated between 89 and 93 per cent; therefore it requires further improvement. Satisfaction is expressed concerning the operating safety that has been attained in commercial aviation. Taking all in all, the technical performance ability of the air service has attained a rather high degree.

However, the economic phase, and the high self-costs or expenditures in air transport systems are still a hindrance to their deserved development. For the year 1926 the average carrying capacity of the planes and the self-costs for the United States, Germany, England and France, when considering a full utilization of the carrying capacity of the airplanes are shown in Table 3.

However, in practice these full capacity loads are not attained and this adds to a further increase in costs. The actual load carried by the various air transport concerns, figured upon the basis of full capacity loads, has fluctuated during the last years from about 40 to 60 per cent and it is 50 per cent on the average. Therefore the above-

Table 1

Water vehicles traveling	5 km. or 3.1 miles per hour	1 kg. or 2.2 lb.
Water vehicles traveling	9 km. or 5.6 miles per hour	2.5 kg. or 5.5 lb.
Railway trains traveling	60 km. or 37 miles per hour	4 kg. or 8.8 lb.
Motor vehicles traveling	40 km. or 25 miles per hour	15 kg. or 33 lb.
Airplanes traveling	150 km. or 93 miles per hour	150 kg. or 330 lb.

Table 2

Country	Year	Route km.*
Germany	1927	28,100
France	1926	12,862
United States	1927	12,000
Russia	1926	5,998
Italy	1926	3,844
Holland	1926	2,731
Switzerland	1926	2,564
England	1926	2,147
Sweden	1926	1,937

*1 km. is 0.62 mile.

Table 3

	U. S.	Germany	England	France
Average load-carrying capacity of airplanes in lb.	1,146	1,102	1,764	915
Self-costs per 1 flying km.	$0.76	$0.80	$1.00	$0.77
Self-costs per 1 ton km.	1.46	1.64	1.25	1.82

Table 4

Sources	U.S.	Germany	England	France
Air transport recepits	46	14.3	37	14.5
Government aid	37	70	59	67.7
Other aids	17	15.3	4	17.8

mentioned figures must be doubled; accordingly, the actually existing self-costs increase to about $2.45 to $3.64 per 1 ton km. and to about $0.20 to $0.29 for one person-km. exclusive of baggage. Compared with the railway tariffs, the costs of air transport are therefore exceptionally high. Hence, upon nearly all air transport routes only a portion of the self-costs or expenses can be covered with actual receipts. In the year 1926 the sources of the monies received by the air transport organizations giving the percentage derived from each source are given in Table 4, on page 24.

The comparatively better coverage of the expenses in the United States and in England, as compared to France and Germany, is due to the fact that because of the generally better economical conditions and the more favorable geographical pre-requirements for the air transport system, such as greater distances, through-routes over land and water as for instance Paris to London, the tariffs could be placed higher. Thus, in England the air passenger rate per person km. is 4.79 to 6.42 cents, in the United States 8.09 cents and in Germany 3.33 cents. A balancing of the expenditures and receipts can be effected at the present only by way of the air mail service. In Germany, for example, the rate for air mail letters weighing up to 20 grams or 0.7 oz. is 5.95 cents. Figured for an average distance of 500 km. or 312 miles, this would be $5.95 per ton km.

An analysis of the self-costs in air transport shows that a large portion of it applies to the payment and maintenance of the airplanes. For a larger air transport system, the costs distribute themselves as follows in per cent: feeder service to air port, 4.3; maintenance of airplanes, 19.5; fuel, 14.2; pilot and flying premiums, 8; other variable costs, 6.8; interest on operating material, 2.8; interest on airports, 3.6; payments, etc., 25.8; central or head organization, 7.2; flying management and airport, 7.8.

According to Director O. Merkel of the Deutsche Luft-Hansa, an economic success may be expected of the air transport business within the next 5 to 10 years, in spite of these present very unfavorable operating conditions. Several companies have already succeeded in reducing the above-named self-costs as much as $1.25 per ton km and in increasing their actual receipts. In the Deutsche Luft-Hansa the self-costs or expenditures were about $1.19 per ton km. in the year 1927, and their receipts about 30 per cent of this. The French companies Air Union, and Societe Generale de Transport Aerien, had expenditures of $1.06 and $0.89 per ton km. The advances which have been made annually in the direction of decreasing the expenditures, have in part been surprisingly large. The English organization, Imperial Airways, Ltd., could reduce its self-costs of 1926-1927 21 per cent as compared to the preceding year. The Dutch concern Koninklijke Luchtvaart Maatchappij had the following self-costs or expenditures since 1922:

Year	Per ton km.
1922	$1.92
1923	1.21
1924	0.90
1925	0.73
1926	0.53

There are undoubtedly many possibilities of increasing the economies of operating air transport systems, as for example, by way of reducing the purchasing costs of operating equipment, therefore also of the insurance rates on the entire capital service; by improvements in airplanes and motors so that the maintenance and overhauling is lessened and simplified; by increasing the receipts in adapting the air transport service to the transport requirements; by expanding the handling of freight or mail, which items are in a situation to bear high transportation rates, and by a better utilization of the ground equipment through an increase in air traffic, combining air and night service, and other schemes. Further means towards making air transport a business success are the utilization of the latest developments in airplane and air motor engineering, acquiring the latest in operating and transport knowledge, adjusting the air transport system rationally to the expected certain limits of the field, considering the various characteristics of the air transport service such as distance between various routes, etc., all which items should be considered as a unit to make commercial aviation a success.*

Popular Aviation will endeavor, each month, to present to its readers an article taken from one of the leading European publications, in the belief that foreign opinion on the various problems connected with aviation will be interesting. Bear in mind that the publication of these articles will in no sense mean an endorsement of the opinions set forth. We leave the matter of drawing conclusions to our readers.

*These facts have been adapted from an article by K. Ruehl in the *Zeitschrift des Vereines Deutscher Ingenieure* of July 28, 1928, pp. 1059-1060.

French Air Regulations

Flyers in France must keep an altitude of 500 meters or more above populous districts of whatever size, according to air regulations now effective in France.

Aircraft flying over inland navigable channels (streams, rivers, canals or lakes) and their dependencies shall be subject to the general rules for air traffic.

Except in alighting or taking off, aircraft in flight shall remain at such height as to enable them to alight out of the way of the subjacent river-craft and in no case shall they impede the free movement of the latter.

All aircraft in contact with the water shall conform to inland river-craft and shall be subject to the rules governing such craft.

Taking off or alighting at night, save in the case of extreme necessity, may be effected only on such of these areas as are specially designated for the purpose.

Aircraft may not take off unless it has sufficient space available to fly at a height of not less than fifty meters above the nearest obstruction and to remain continually at a distance of not less than 200 meters of any river craft in the direction of flight and not less than fifty meters in a transversal direction.

In foggy weather such as to preclude horizontal visibility at a distance of more than 400 meters, aircraft are prohibited from taking off except in case of extreme necessity.

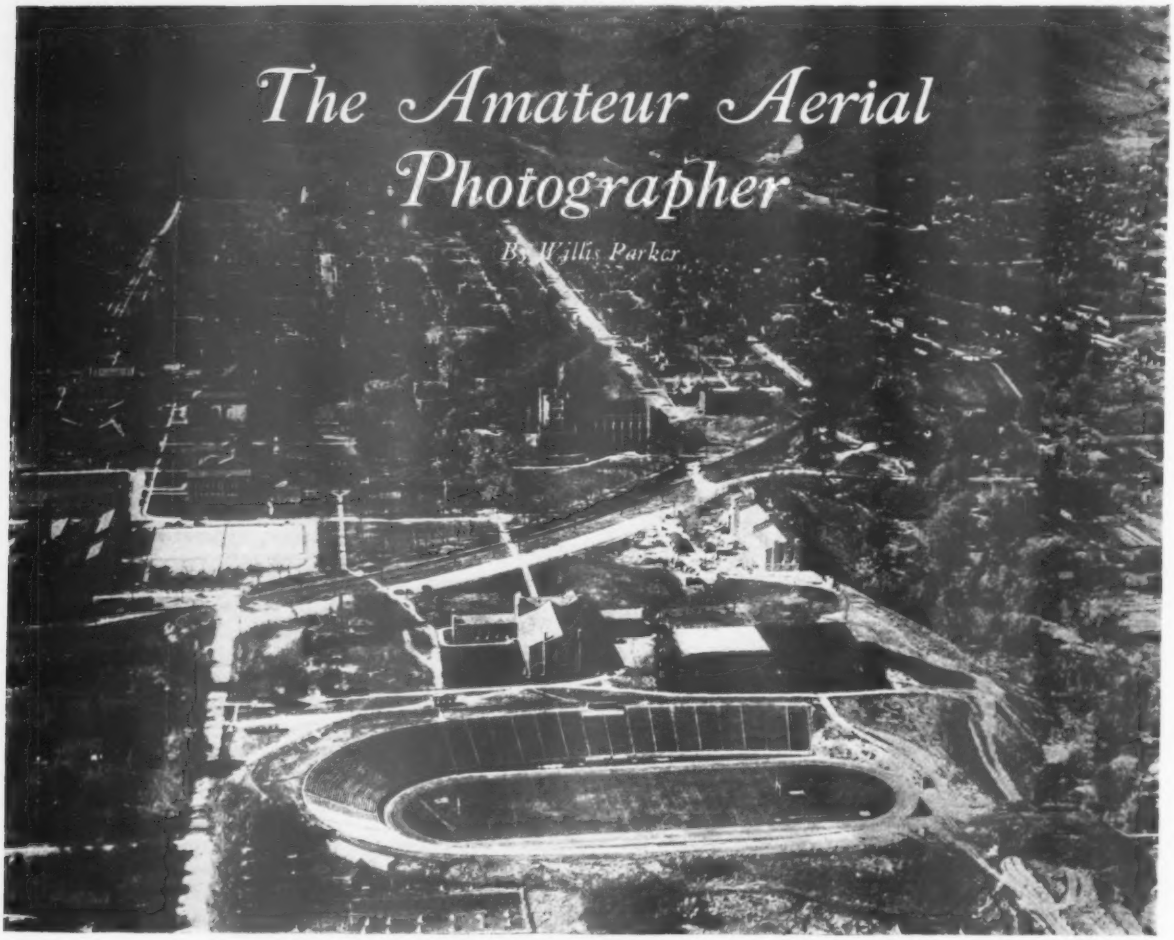
Aircraft flying over populous districts shall conform to the following rules:

No populous district of whatever size, no place frequented by a gathering of people, such as a beach, hippodrome, stadium, etc., shall be flown over at a height of less than 500 meters.

Towns of 10,000 to 100,000 inhabitants shall not be flown over at a height of less than 500 meters for multi-motored aircraft and 2,000 meters for single-engined machines.

The Amateur Aerial Photographer

By Willis Parker



The city of Boulder, Colorado, from the air.

SO extensively and effectively has the photographic industry educated the American public to the joys of securing on films the records of outings, the smiling youngsters, and the beauties of nature that seldom do we fail to include a small camera in our equipment when we climb into an automobile, board a train or embark on a ship for journeys of a recreational nature. The Sunday afternoon motor-picnic is sufficient excuse to pack the camera in the basket along with the sandwiches, devilled eggs and angel food cake.

With the airplane coming into increasing prominence for recreation, as well as business, it is not unlikely that the amateur photographer will strap a camera over his shoulder when he climbs into the cock-pit of a plane for a hop of a few miles in the air, and will desire to record what he sees from the air on the films so that prints may be included in the "snapshot album." What may he expect from his efforts and how should he handle his camera when in the air?

Admitting from the start that the best photographs are obtained through the use of high priced equipment in the hands of expert photographers, regardless of whether the picture is taken on the ground or from the air, we also must admit that the amateur, with his cheaper equipment may obtain results from the air just as satisfactory to him as he is able, with the same equipment, to get on the ground, providing he observes a few simple rules and uses common sense.

From J. Winton Lemen, an amateur aerial photographer who has since developed into an expert, comes the assertion that his first experiences with aerial photography were accomplished with an ordinary camera and that he obtained results that were surprising. As he increased his knowledge of "shooting" pictures from the air, he developed special equipment of his own designing which has bettered the results and he has become widely known in Denver and the Rocky Mountain region for the excellence of his work. He is a staff photographer on the Denver Rocky Mountain News and what he has learned should prove of assistance to any person who desires to record his aerial journey with a camera.

"The amateur photographer, with his ordinary camera, has two things to watch," he explained. "First is the vibration of the aircraft engine, and second is the powerful blast of air that sweeps back from the propeller. If these two factors are considered and allowances made for them, there should be little difficulty in getting a picture that will prove satisfactory. One need not worry about distance, if he is above 400 feet, and a fixed focus lens will do the work. In other words, set your camera on 'infinity' and the images will be in focus regardless of from what height the picture is taken—just so it is above 400 feet.

"They would be in focus under 400 feet, but the ground speed would be

so great that the images would be blurry unless the camera was equipped with a very fast shutter.

"I never take a picture unless the sun is shining, for it usually is a waste of effort. It is possible to get pictures without sunlight, but one will be disappointed in the results. Also it is best to take them when the sun's rays are slanting in order to obtain sufficient shadows as to provide some relief to the picture. Shooting at noon, for example, gives you a flat picture in which none of the images stand out in prominence.

"For my work I use a camera which will permit shutter speeds of 300th of a second. Such a speed overcomes blurriness when taking pictures below 400 feet. I use a medium stop. I should advise the amateur to set his camera on its fastest speed and stop it down to F.11, or apertures of similar size.

"There is one thing necessary, and that is to hold tight to the camera lest the wind blow it out of your hand.

"Because of the vibration of the engines, I find it best to always ask the pilot to throttle down when I get ready to take a picture, and then I wait a few moments until the vibration has ceased and the plane is soaring quietly and smoothly along. Vibration is likely to make the picture blurry and the heavy blast from the whirling propeller makes it difficult to hold the camera in position.

"One doesn't find difficulty bringing the object into the photographic field, because he is so high in the air, and I seldom pay any attention to the view finder—merely sight along the length of the camera box. I have equipped my camera with a small brass cylinder in which are two crossed lines and I can look down this cylinder to find my image if I think it is necessary.

"I would advise against using a camera with bellows, if possible, for the wind plays havoc with the bellows and is likely to ruin a good picture. If you haven't a box camera, try to hold the camera in a position protected from the wind."

Mr. Lemen calls his camera his "Apple Box." Almost any amateur who is handy with saw, hammer and plane, can construct one, for it is merely a square box with the lens attached to one end and a plate holder to the other, and light proof. The lens is inserted back about two inches into the box so that the wind cannot reach it when the box is pointed over the side of the plane. Two stout handles insure a firm grasp on it, and the release cable is attached to one of the handles where it can be quickly worked with the thumb.

It is not good technic, says Mr. Lemen, to permit a portion of the airplane's wing to show in the picture. But the amateur cannot expect to have everything in his favor unless the pilot is accommodating and will "kick" the ship around to permit clearance. Even with an accommodating pilot, it is sometimes impractical and unsafe for him to accommodate the photographer.

"Not long ago, I took a trip over the mountains," explained Mr. Lemen, "to get pictures of famous peaks from the air. The pilot always had accommodated me, but on this trip he dared not, for the air was choppy and the pilot had to consider the safety of the ship and of ourselves. We climbed to 17,000 feet and he concerned himself entirely with the navigation of the plane. I had to 'shoot' when and how I could. He dared not throttle down the motor or swing around just when and where I wanted him to. I got some excellent pictures of the scenery, anyway, but some of the prints showed portions of the wings of the plane.

J. Winton Lemen, aerial staff photographer for the Rocky Mountain News.

"That was one of the roughest photographing trips I ever have taken. Once the plane hit an upward current of air and I found myself down in the bottom of the ship. Then we struck a down current, and I apparently went up in the air as the plane dropped from under me. I was strapped in, but had not been sitting tightly in my seat because I was concerned with getting my pictures and had half risen out of the seat.

"My first experience with aerial photography was also my first ride in a plane. A picture of a parachute jump was wanted, so I grabbed my ordinary camera and went up in another plane. I was so much concerned with getting the picture, that I didn't get any thrill out of the ride. I had to take another trip to find out what a ride in an airplane felt like. Incidentally, the picture I took was a dandy.

"My most thrilling trip was when I was sent along with other newspaper men to assist in the search for the Lamar bank bandits who had shot and killed four men and were believed to be cornered in western Kansas. We made the trip in a cabin plane and were out for a couple of days. We knew that among the automobiles we could see from the air, was one supposed to contain the bandits—which one, nobody knew. What if we should happen upon the bandits and they should open fire on us? Once we saw a suspicious car and circled it. It stopped and some of the occupants got out and flagged us down. We circled several times to make them out, if possible, and landed in a field nearby. We had guns drawn and waited for the motorists to approach us. It turned out that they were deputy sheriffs and not bandits.

"The bandits never were caught and I never got my picture."

Aerial Tax Assessing

Another application of weapons-of-war turned to profitable peacetime use is demonstrated by the new system of making taxation maps as used in the State of Connecticut, E. R. Polley of the Fairchild Aerial Surveys reports. The airplane, Mr. Polley notes, is used to spot tax dodgers in much the same way it was used to locate enemy trenches in the late war.

The plane, flying a mile high over city or town takes photographs with a specially constructed aerial camera. This remarkable device, which weighs less than the average twelve-year-old boy and costs more than a high class automobile, obtains photographs at high altitudes which show every square inch of a town, every lot and parcel of property, every building, sidewalk and tree. Absolutely nothing, according to Mr. Polley, can escape its eagle eye.

Belgium in the Air

By Paul E. Lamarche, Jr.

A Sabena Line Handley-Page flying over the low country near Brussels.

IN these days of trans-Atlantic flights, expeditions to the two Poles and other record breaking achievements in the aeronautical world one hears little of what is going on among smaller nations in the development of aviation. Yet in many instances, though perhaps unnoticed through lack of big publicity that follows the establishment of a new record or some outstanding achievement, the smaller nations have developed systems of airways that are worthy of attention and are of interest to those who follow the activities of the other fellow. Belgium is one of the smallest nations of Europe and yet has developed a system of airways both in Europe and in Africa which, though not large, are of interest. This is especially true of their efforts in the Belgian Congo.

Before one can give a description of Belgian civil aviation one must properly make the division between their air systems in Europe and those in the Belgian Congo, for, while they are both operated by the same organization, the scope of their activities differs in many respects. All of the Belgian civil air lines are operated by the *Société Anonyme Belge d'Exploitation de la Navigation Aérienne* which is more popularly known as the Sabena Line, the name being composed of the first letters. This company was formed in 1922 and is supported partially by private interests and in part by the Belgian Government which gives them an annual appropriation, although the Belgian Government does not grant large subsidies, as do some of the Governments of Europe, for the maintenance of air lines. The operation of the Sabena is controlled by the *Ministère des Transports et Communications*, there being, as in France, no Air Ministry in Belgium. The Sabena is under the immediate supervision of Major General van Crombrugge whose position is that of *Directeur Générale de l'Administration de l'Aéronautique* and whose headquarters are in Brussels, in which city are likewise the headquarters of the Sabena Line.

For a small country whose total area amounts to but 11,752 square miles, one finds a surprising amount of commercial activity in Belgium. The Brussels airport, known as Haren, is always the scene of much activity especially during the summer months when the services are augmented and while not as large as some of the foreign airports it is comparable with some of the best with its equipment and operation. Though many of the commercial planes that arrive at and depart from this field bear the identification marks of foreign nations on their wings and fuselages, the planes of the Sabena Line carry their share of the air traffic that uses their principal airport. The Belgians have not developed air lines in Europe very extensively since all of their border countries have at the same time large air developments and further exploitation would be superfluous. The development of the Sabena Line followed closely that of their competitor nations and their planes were operated at the outset between Brussels and London in conjunction with the English Imperial Airways Service. At one time Belgian planes called at Strasbourg from Brussels but this service was later discontinued. They eventually extended their lines radiating from Brussels so that they called at Rotterdam in Holland and Basle in Switzerland but these two routes are now taken over by the Dutch K. L. M. service. In April of this year the Sabena Line inaugurated her service between Brussels and Cologne and her present routes now include this as well as lines between Brussels and London, Brussels and Antwerp and Brussels and Ostend. The operation of these services is so arranged as to allow connections with the German lines at Cologne or the foreign lines that call at Brussels. These connecting routes now make it possible to fly from Brussels to Berlin, via Cologne, in five hours and a half, and to Copenhagen by connection with the Dutch service at Brussels in six hours. Prague is but seven hours by connecting air lines from Brussels and most of the important cities on the Continent can now be reached by the air line from Brussels through corresponding lines.

Among the principal foreign lines that call at the Brussels airport are the Imperial Airways who operate a service between London-Brussels and Cologne as well as a summer service to Ostend. The French S. G. T. A. Line (*Société Générale de Transport Aérien* formerly Farman Line) operating from Paris to Amsterdam calls here as well as the Dutch K. L. M. Line which has in addition

to the Amsterdam-Rotterdam-Brussels-Paris service, a service between Amsterdam-Rotterdam-Brussels and Basle. An idea of the activity of the Brussels field can be obtained from the following figures covering April and May of this year which are in advance of the summer season when activity is greater. (See Table 1.)

Belgian planes including those used in the Belgian Congo have to date carried a total of 16,924 passengers, 215,500 kilograms of freight and 145,000 kilograms of mail. The partial tabulation (Table 2) of passengers for the first part of this year is interesting inasmuch as it shows who uses the planes that call at Belgian airports and it must be remembered that English, French and Dutch planes use these airports.

The principal civil airports in Belgium are those at Brussels, Ostend and Antwerp (Deune). The Haren Field of Brussels, which is located just outside of the city in Evére, is the most important and is used both as a military and commercial air field and with the exception of Ostend where the Imperial Airways planes call during the summer months, it is the only field used by foreign planes. At present new buildings are being built which when completed will add greatly to the improvement of the airport. At Ostend likewise, improvements are being made so as to handle seaplanes and serve as a marine airport. There are also other fields used principally for military purposes located at Gosselles (Charleroi), Courtrai, Diest, Liége, Nivelles and Tirlemont. Three other auxiliary air fields used by the military service but at which no personnel is maintained are located at Beverloo, Brasschart and Elsenborn.

Rear view of Handley-Page W-8 Plane used in the Sabena Line service between Brussels and Cologne—Accommodations for twelve.

Table 1

April, 1928

	Planes	Passengers	Freight	Post
Departures	265	962	29,410 kgs.	2303 kgs.
Arrivals	264	929	29,044 kgs.	2734 kgs.
		May		
Departures	374	1306	35,959 kgs.	3577 kgs.
Arrivals	374	1289	37,945 kgs.	3955 kgs.

Table 2

1928

	Jan.	Feb.	March	April
Belgian	29	48	75	102
Dutch	175	200	293	430
English	102	146	221	350
French	94	133	227	297
Americans	29	25	86	145

A Fokker II used by the Sabena Line on the Brussels-Antwerp service. It has accommodations for four passengers.

Adjacent to the Haren Field of Brussels is the aircraft plant of the *Société Anonyme Belge de Constructions Aéronautiques*, often referred to as the SABCA plant. This organization is closely related to the Sabena and most of the planes used by the Sabena Line are built in this plant. They are principally engaged in the construction of De Havilland, Handley-Page, Nieuport-Delage, Avro, Avia and Ansaldo planes for the Belgian Government which are built under license from those companies. Most of these planes are built for the military services while the Handley-Page planes are built for use on the Sabena Line both in Belgium and Africa. Three of their engineers have designed and constructed several light planes that have proven successful. While Handley-Page planes are used on the longer routes of the Sabena in Europe as well as Africa, Fokker II planes are used on the shorter routes

Side view of Handley-Page in the Sabena Line service. These planes are built under license in a plant adjacent to the Brussels Field. The same type, with three motors, is used in the Congo.

in Belgium such as from Brussels to Antwerp. Another aeroplane construction company is the Zacco plant whose appellation is made up of the first letters of the name Zeebrugge Aeronautical Construction Co. and whose plant is located in Brussels. Their output consists principally of light planes while a small military plane has also been produced by this plant. The *Compagnie Aérienne Belge*, another commercial air company, devotes its activities to aerial photographic work both in Belgium and in the Congo.

In the Belgian Congo, the development of commercial air lines is more extensive and while a comparatively recent development its operation has been very successful. The Belgian Congo is a vast territory which became a Belgian Colony in 1908 and whose total area amounts to 909,654 square miles or about eighty times the area of Belgium. The territory of the Belgian Congo is bordered on the north by French Equatorial Africa and the Anglo Egyptian Soudan. To the east lies Kenia and the Territory of Tanganyika which before the war was a German possession and is now British. To the south is Angola and Northern Rhodesia and it is interesting to note that the British have been making efforts towards developing airways in Rhodesia for several years. West of the Belgian Congo is Angola except for a small strip of coast on the Atlantic Ocean at the mouth of the Congo River at which the seaport town of Boma is located.

Travel in this equatorial country has always been at best an arduous undertaking and often a trip between two towns four hundred miles apart requires from three to four weeks of travel that leads through hilly and mountainous country as well as vast forests and jungles. The total white population amounts to approximately 11,000 many of whom are engaged in the exploitation of the principal industries such as lumber and the mining of copper and other valuable minerals which is carried on extensively. Most of the important towns in this vast territory are situated far into the interior and the chief connecting link with Belgium and the rest of Europe is by way of Boma where steamers from Antwerp arrive. Travel from Boma to such distant towns as Stanleyville, Leopoldville or Elisabethville, however, usually involves trips lasting over a period of weeks.

The Sabena Line of Belgium in 1923 backed by the Belgian Government and certain private societies to the extent of 6,000,000 Belgian francs began the development of a system of airways which is now creating much interest among other nations who have African possessions. As a result of their efforts during the past five years they have established a system of airways that operate in conjunction with the arrivals and departures of the steamers of the *Compagnie Belge Maritime du Congo* at Boma. Despite many obstacles that had to be overcome the operation of these airlines is now carried on with as much efficiency and regularity as the air lines in Europe. Because of the mountainous character of much of the country and the vast jungles over which planes would be required to fly there was at first much difficulty in finding suitable locations for flying fields and emergency landing places. The Equator runs through this country and the operation of air lines must reckon with the burning tropical sun, seasonal tornados and the heavy torrential rains during the rainy season. In 1925 the Belgian Government sent out several missions to survey the country with the development of further air lines in view, particularly in the directions of the Nile and the Sahara.

The first efforts of the Sabena Line in the Belgian Congo were the establishment of an air service from

The Prince Henry of the Imperial Airways of London being refueled at Brussels before continuing to Cologne.

the Lower Congo to the Province of Kantanga. In 1925 the line from Leopoldville to Luebo was inaugurated and in 1926 it was extended to N'Gule near Elisabethville. During 1927 air service between Boma and Elisabethville began while on December 14th last planes began flying from Luebo to Tshikapa. Other developments took place and now a regular system of continuous air services operates between the seaport town of Boma and the principal inland towns.

The principal and longest air line now operating in the Congo is the line from Boma to Elisabethville and the trip is completed in three stages which includes a total of eighteen hours flying over a distance of 2,050 kilometres. Together with time taken out for stops for connections with other lines the trip requires six days. An example of how this service is operated is shown by their air schedule for last April. The steamer for Boma left Antwerp on April 10th arriving at Boma on the 26th. On the 27th the Sabena plane left Boma and flew as far as Leopoldville making stops at Matadi and Thysville. At Leopoldville one can take a plane to Coquilhatville a distance of 735 kilometres that requires a flight of six and a half hours. On April 30th the plane flew to Luebo making stops at Bandundu (Dima Kwili), and Port Francqui (Ilebo). At Luebo one can change for a plane to Tshikapa a distance of 160 kilometres requiring an hour and a half or to Lusambo which is a flight over a distance of 325 kilometres with three and a quarter hours in the air and a stop at Lulabourg. On the first of May the plane continued on its trip to Elisabethville, stopping at Kanda Kanda, Kamina, Bukama and finally N'Gule near to Elisabethville. Thus it can be seen that this network of air lines all correspond with each other in weekly and twice weekly services between the principal inland towns and the port of Boma with the result that travel to and from Europe as well as the transportation of mails and freight is greatly accelerated.

A French Farman "Jabiru" at Brussels where it stops enroute from Paris to Amsterdam. The French line uses both single and four motored "Jabiru" planes; this one is equipped with a 500 h. p. Hispano-Suiza.

The planes on these lines are well patronized for there is always a demand for their services among the white population. Mail and freight are likewise carried in sizeable quantities. The tabulation (Table 3) of figures that cover the activities of the Sabena in Africa for several months in this and last year shows to what an extent this traffic is carried on and it must be remembered that the planes have accommodations for fourteen passengers and do not fly daily.

Table 3

Month	Passengers	Mail	Freight	Distance
November, 1927	64	2780 kgs.	68 kgs.	13,560 kms.
December, 1927	81	2300 "	31 "	11,160 "
January, 1928	132	1750 "	430 "	..... "
February, 1928	...	1280 "	336 "	17,640 "
April, 1928	119	1440 "	360 "	17,760 "

In November of 1927 Sabena planes carried passengers, mail and freight over the Congo for a total of 113 hours in the air. In December of the same year the flying time was 93 hours. In February of 1928 the planes flew for a total of 147 hours over their regular routes while April of the same year saw 148 hours of air travel in this Belgian Colony.

The principal air field of the Sabena service in the Congo is at Leopoldville. Here there is a field of 250 acres where hangars of modern brick construction have been built large enough to accommodate eight tri-motor Handley-Page planes.

(*Continued on page* 120)

Fokker II Monoplanes used for short distances by the Sabena Line at Brussels.

Aircraft Operation Laws

By Andrew R. Boone

ALL persons concerned with the operation of aircraft for commercial purposes agree that regulations must be kept at once uniform and as simple as possible. Some states have adopted the "uniform State law," promulgated by the American Bar Association but with variations, thereby indicating definitely even this early that no group will accept a "uniform" regulation merely because another group has so designated it.

Yet serious efforts are being made, both by the Department of Commerce and others interested, to bring about simplification of rules and laws respecting private planes and commercial aircraft operating in both inter-state and intra-state commerce. In this they are not interested in "states' rights" as a principle, but rather in an effective and harmonious means of control.

Before proceeding with a discussion of what has been undertaken in this direction, however, it may be interesting to consider briefly what has been done in the various states. A "uniform state law of aeronautics" has been adopted, and is still in force, in some states and territories. In Michigan it has been supplemented by regulatory legislation. The regulatory provisions added to the uniform state law as adopted in Hawaii were superseded by the Federal Air Commerce Act of 1926.

At this writing, according to information compiled by Mr. Frank McKee, aviation director for the California Development Association, looking toward drafting a comprehensive regulatory law by the California legislature, the following states have passed no laws affecting aircraft: Alabama, Arizona, Georgia, Illinois, Iowa, Massachusetts, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Virginia, Washington, West Virginia and Wyoming.

Delaware, Idaho, Indiana, Maryland, Michigan, North Dakota and Utah have adopted the Uniform state law, with minor variations.

Oregon has adopted two laws on the general subject while the following have on their statute books one law each pointing toward regulation: Arkansas, California, Colorado, Connecticut, Florida, Kansas, Louisiana, Maine, Minnesota, Pennsylvania, Vermont, Wisconsin and Kentucky.

As a point of departure, the uniform state law should be put down as probably the one piece of legislation more to the point and more simple in its application than any other. It will serve as a reference for states having no laws and indicate to some of them a means for avoiding later difficulties. It follows:

AN ACT CONCERNING AERONAUTICS AND TO MAKE UNIFORM THE LAW WITH REFERENCE THERETO

Be it enacted—

Section 1. (Definition of terms.) In this Act "aircraft" includes balloons, airplanes, hydroplanes and every other vehicle used for navigation through the air. A hydroplane, while at rest on water, and while being operated on or immediately above water, shall be governed by the rules regarding water navigation; while being operated through the air otherwise than immediately above water, it shall be treated as an aircraft.

"Aeronaut" includes aviator, pilot, balloonist, and every other person having any part in the operation of aircraft while in flight.

"Passenger" includes any person riding in an aircraft but having no part in its operation.

(The words "hydroplane" and "aeronaut" are erroneously used, according to official nomenclature.)

Sec. 2. (Sovereignty in space.) Sovereignty in the space above the lands and waters of State is declared to rest in the State, except where granted to and assumed by the United States pursuant to a constitutional grant from the people of the State.

Note: Hawaii substitutes "Territory" for "State." Both Hawaii and Michigan omit the words "pursuant to a constitutional grant from the people of the State."

Sec. 3. (Ownership of space.) The ownership of the space above the lands and waters of this State is declared to be vested in the several owners of the surface beneath, subject to the right of flight described in Section 4.

Note: Idaho omits the words "subject to the right of flight described in Section 4"; deleted on amendment.

Sec. 4. (Lawfulness of flight.) Flight in aircraft over the lands and waters of this State is lawful, unless at such a low altitude as to interfere with the then existing use by the owner, or unless so conducted as to be imminently dangerous to persons or property lawfully on the land or water beneath. The landing of an aircraft on the lands or waters of another, without his consent, is unlawful, except in the case of a forced landing. For damages caused by a forced landing, however, the owners or lessee of the aircraft or the aeronaut shall be liable as provided in Section 5.

Note: Utah adds "or damaging" after the word "dangerous."

Sec. 5. (Damage on land.) The owner of every aircraft which is operated over the lands or waters of this State is absolutely liable for injuries to persons or property on the land or water beneath, caused by the ascent, descent or flight of the aircraft, or the dropping or falling of any object therefrom, whether such owner was negligent or not, unless the injury is caused in whole or in part by the negligence of the person injured, or of the owner or bailee of the property injured. If the aircraft is leased at the time of the injury to person or property, both owner and lessee shall be liable, and they may be sued jointly, or either or both of them may be sued separately. An aeronaut who is not the owner or lessee shall be liable only for the consequences of his own negligence. The injured person, or owner or bailee of the injured property, shall have a lien on the aircraft causing the injury to the extent of the damage caused by the aircraft or objects falling from it.

Note: Utah adds "or damage" after the words "liable for injuries" and after the words "causing the injury." There is also inserted "injury or" after the words "to the extent of the."

Sec. 6. (Collision of aircraft.) The liability of the owner of one aircraft, to the owner of another aircraft, or to aeronauts or passengers on either aircraft, for damage caused by collision on land or in the air shall be

determined by the rules of law applicable to torts on land.

Sec. 7. (Jurisdiction over crimes and torts.) All crimes, torts and other wrongs committed by or against an aeronaut or passenger while in flight over this State shall be governed by the laws of this State; and the question whether damage occasioned by or to an aircraft while in flight over this State constitutes a tort, crime or other wrong by or against the owner of such aircraft shall be determined by the laws of this State.

Sec. 8. (Jurisdiction over contracts.) All contractual and other legal relations entered into by aeronauts or passengers while in flight over this State shall have the same effect as if entered into on the land or water beneath.

Sec. 9. (Dangerous flying a misdemeanor.) Any aeronaut or passenger, who, while in flight over a thickly inhabited area or over a public gathering within this State, shall engage in trick or acrobatic flying, or in any acrobatic feat, or shall, except while in landing or taking off, fly at such a low level as to endanger the persons on the surface beneath, or drop any object except loose water or loose sand ballast, shall be guilty of a misdemeanor and punishable by a fine or not more than $500 or imprisonment for not more than 1 year, or both.

Note: Idaho sets the penalty as $100, or 6 months, or both. Maryland sets penalty at $1,000 or 6 months or both. Nevada makes the imprisonment 6 months. In South Dakota the fine is $1,000 and imprisonment 6 months. Utah adds "loose sheets of paper" after "water" and sets the fine at $300 and the imprisonment 6 months. Vermont's fine is $100. Hawaii adds "or paper handbills" after "ballast" and sets the fine at $1,000.

Sec. 10. (Hunting from aircraft a misdemeanor.) Any aeronaut or passenger who, while in flight within this State, shall intentionally kill or attempt to kill any birds or animals shall be guilty of a misdemeanor and punishable by a fine for not more than ( ) or by imprisonment for not more than ( ) or both.

Sec. 11. (Uniformity of interpretation.) This Act shall be so interpreted and construed as to effectuate its general purpose to make uniform the law of those States which enact it and to harmonize, as far as possible, with Federal laws and regulations on the subject of aeronautics.

Note: Nevada adds at the end of this section: "It shall not be interpreted or construed to apply in any manner to aircraft owned and operated by the Federal Government." Hawaii adds "and Territories" after "States." Michigan omits this section.

Sec. 12. (Short title.) This Act may be cited as the Uniform State Law for Aeronautics.

Sec. 13. (Repeal.) All Acts or parts of Acts which are inconsistent with the provisions of this Act are hereby repealed.

Sec. 14. (Time of taking effect.) This Act shall take effect ( )."

California and some other states, in laws not following the above test, have provided that their statutes shall be automatically repealed with the passage of legislation by Congress "to control and direct the operation of *all* air craft over all of the territory and territorial waters of the United States." Some are of the opinion the states affected thus waive their sovereignty respecting regulation of air travel in favor of the national congress, yet a recent opinion from U. S. Webb, attorney general for California, held that the Air Commerce Act of 1926, chapter 344, 44 Statutes 568, is concerned with inter-state commerce, excluding intra-state commerce, and therefore does not nullify the state laws.

The California law said in part: "It is hereby determined that until the Congress of the United States passes legislation to control and direct the operation of all aircraft over all of the territory and territorial waters of the United States, at which time the provisions of this act shall automatically cease and become void, all aircraft operating within the geographical limits of the State of California shall be governed by the provisions hereof."

The act also provides that, "No aircraft shall be flown from any point to any point in this State unless said aircraft is registered as provided by Section 3 of this Act relative to the registration of aircraft and the licensing of aeronauts; provided, that the said non-resident shall secure special authority from the superintendent of the motor vehicle department before any exhibition flight."

Concerning the apparent inconsistency between the state and federal law, Mr. Webb remarked that in a construction of the provisions of a statute the intent of the legislature consistent with reason and logic should govern, as it has been held that an intent which is illogical or obscure may not be attributed in such construction. "It therefore appears," he said, "that Section 13 of the California statute was intended to operate until the Congress of the United States saw fit to legislate upon the entire subject of aircraft and aeronauts operating over all the territory and territorial waters of the United States. An examination of the Air Commerce Act of 1926, passed by Congress, discloses the fact that jurisdiction was not assumed over aircraft or aeronauts operating wholly within the state."

By the omission of the Air Commerce Act to assume jurisdiction over internal or intra-state commerce, or over aircraft operated for

Police plane used by the air control board of San Diego

pleasure, he pointed out, Congress expressly and "properly" leaves free to the different states the right to regulate aircraft and pilots operating within a given state and not crossing any of its territorial borders. Therefore, the act did not include all aircraft, and therefore the California state law, and those others carrying a similar nullification clause, remains in force.

There is nothing peculiar in California's law. It provides that a license shall be issued to a pilot by the superintendent of the motor vehicle department either on examination or recommendation of some qualified flying association or other organization. In any case, however, the applicant must be able to pass the tests required by the Army or Navy for military aviators. The licensee must be 19 years old. Licenses are divided into three classes—those to operate spherical balloons, those to operate dirigibles and those to operate airplanes or heavier-than-air machines. The superintendent may revoke a permit for any cause which he deems sufficient.

Arkansas in her Act of Feb. 16, 1927, created a State Honorary Aircraft Board which consists of three members, "one of whom shall be a Practical Business Man and two (2) qualified air pilots." One of these members is required to be qualified in aeronautical designing and engineering. The Act in some detail defines various terms and fixes the license fee at $50 a year for all commercial planes. Non-residents are not required to pay the $15 fee assessed private operators until they have been in the state fifteen days.

Owners of all aircraft in Florida must pay a license fee of $100 a year. Florida makes no other unusual demands on flyers, however. Kansas' law approximates that of Arkansas. Kentucky went most of the states one better when she set up a fund for use by the Air Board. The legislature appropriated 2.2 cents per resident to be used as an air fund.

Louisiana adopted the viewpoint of protecting those who ride in a public airplane against loss through injury in her Act of June 26, 1926. It is known as a bill "to regulate the business of carrying passengers for hire in airplanes, to require all persons, firms or corporations engaged in said business to furnish indemnity bonds, and to prescribe the punishment for violations of the provisions thereof." Some of its sections will be of interest.

"Section 1. Be it enacted by the legislature of Louisiana, that it shall be the duty of every person, firm or corporation engaged in the business of operating airplanes, whether as owner, lessee or otherwise, for the purpose of carrying passengers for hire in this State, to procure and execute an indemnity bond in the amount hereinafter provided with a good and solvent security company authorized to do business in this state, as surety, with the obligation running in favor of any person who may be injured in person or property, or otherwise suffer loss or damage by the operation of said aeroplane so used by said person, firm or corporation in said business in the state of Louisiana."

Section 2 provides that the bond shall be drawn in favor of the governor of the state to inure to the benefit of anyone injured. And in Section 4 one notes the "joker" . . . . if the said person, firm or corporation engaged in said business uses in said business only one aeroplane which is used or intended to be used for the purpose of carrying passengers for hire in this State, then the amount of said bond shall be the sum of $15,000, and for every additional such aeroplane that the said person, firm or corporation may so use the amount of said bond shall be increased by one thousand dollars." This section fixing the bond is reported by at least one Department of Commerce official to have had the effect of discouraging aviation development in that state. It is not suggested that insurance for carrying companies should be abolished, but it is said this is a drastic measure of its particular type, since it deals in a "prohibitive" way with the small operator.

More and more attention is being drawn to the legal aspects of aviation. Those who are interested do not wish to see the chaotic conditions that obtain in the automobile laws of the different states.

Minnesota's provisions carry particular interest because of the detail into which they go in providing for structural strength requirements for airworthiness of planes. Some of these specifications may be of interest:

To determine structural strength requirements, airplanes in Minnesota are classed according to gross weight in pounds as follows:

Class 1—Up to 2,500
Class 2—From 2,500 to 4,000
Class 3—4,000 to 7,500
Class 4—7,500 to 13,000
Class 5—Over 13,000

The wing-truss analysis must show high and low incidence and inverted flight conditions, and the minimum load factors for such conditions, as when new, must be as follows:

Class	High Incidence	Low Incidence	Inverted Flight	No-e Dive
1	6.5	4.5	2.5	2.0
2	5.8	4.0	2.2	2.0
3	5.2	3.6	2.0	2.0
4	4.8	3.3	1.8	1.8
5	4.0	2.8	1.6	1.6

The fixed and movable control surfaces, as when new, must be designed to withstand at least the following loads:

Class	Ailerons and horizontal tail surfaces lb. per sq. ft.	Vertical tail surfaces
1	30	75 per cent of
2	25	the load re-
3	20	quired for hori-
4	15	zontal tail sur-
5	15	faces.

Of particular interest are the power plane requirements, which specify that it must be equipped with fire wall or equivalent protection, carburetor air intakes opening outside the fuselage and suitable drained, throttle control on multi-engines planes to permit individual and simultaneous control, suitable ventilation for the engine compartments, gravity gasoline feed systems and for planes carrying passengers for hire adequate reserve gasoline supply or a gauge indicating supply.

For all airplanes other than seaplanes, Minnesota also requires them to meet the calculations of both the following formulae:

$$\frac{\text{Gross weight}}{\text{Horsepower}} \times \frac{\text{Gross weight}}{\text{Wing area}} \text{ equals 200 or less}$$

and

$$\frac{\text{Gross weight}}{\text{Horsepower}} + \frac{\text{Gross weight}}{\text{Wing area}} \text{ equals 30 or less}$$

If either calculation exceeds the number specified, the plane must take off in 1,000 feet or less, climb at least 250 feet in first minute and land coming to a full stop without external aid within 1,000 feet. These tests are calculated on the basis of air of a specific weight of 0.07635 and a wind velocity not exceeding 10 m.p.h.

Such requirements as these are isolated, however, and some of the states apparently await federal regu-

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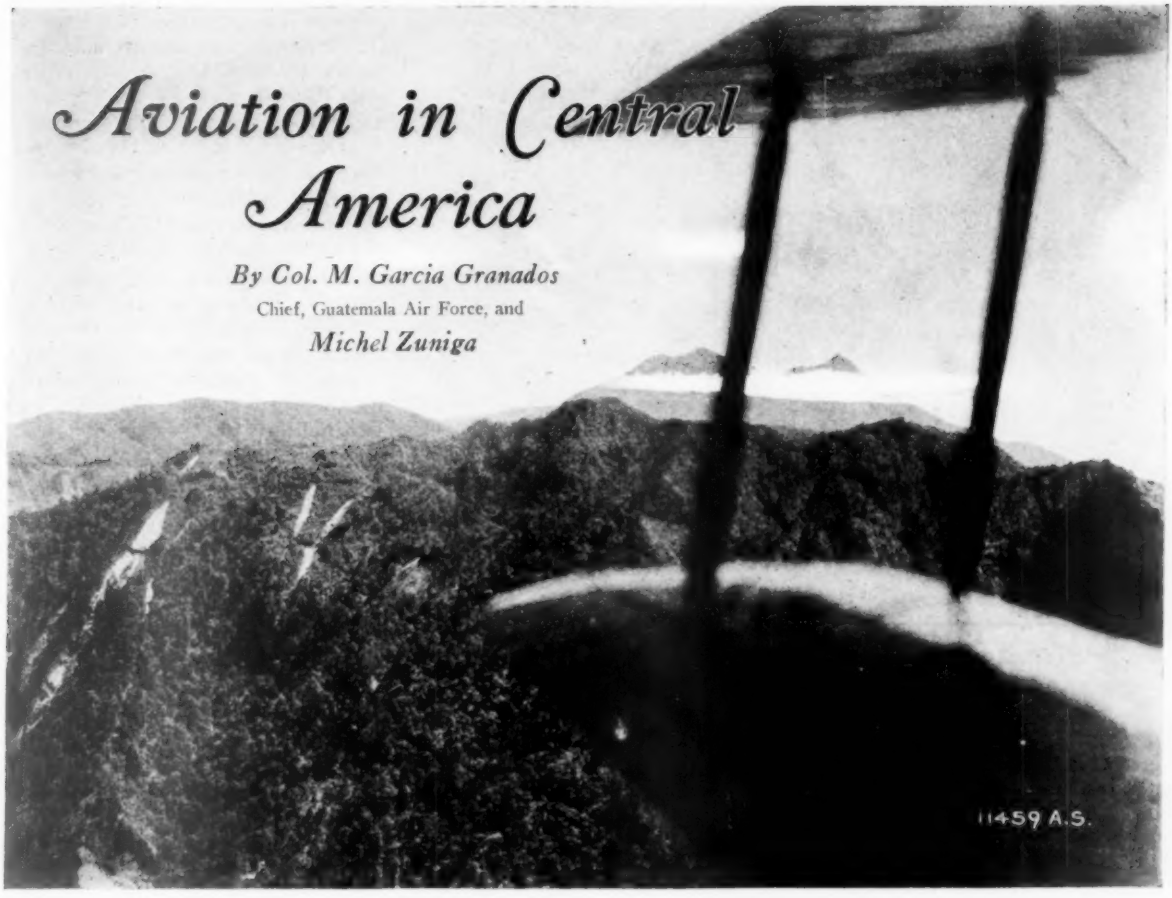
Aviation in Central America

By Col. M. Garcia Granados
Chief, Guatemala Air Force, and
Michel Zuniga



Volcanic country over which Guatemala flyers will carry mail.

NO one in the United States can appreciate without personal experience the importance of the Central American countries to aviation enterprises of the United States. Those five republics are the gateway through which airlines of the future between North and South America will pass. No matter whether a line originates at New York or Seattle, it will pass through Central America, and particularly through Guatemala.

Thus, from an international standpoint, Guatemala is a most important factor in the "air relations" between North and South America. Air relations! New term and new thought. But air relations in the future will be important to the good will between countries. And Guatemala holds the key which will unlock the chest of friendly relations during future years for the United States and those countries south of Mexico.

No one doubts but that in a few years lines will run from both the east and west coasts of the United States, converge in Guatemala, then send planes on to South America. Air travel in Guatemala and elsewhere in that region of the world is possible where rail travel is prohibited by heavy costs arising from frequent and heavy rains. The topography of the countries also discourages railroads in many instances.

Guatemala takes a certain pride in being the first Central American country to inaugurate an airmail line. Its operation will be started during the early fall. Three Ryan monoplanes already have been received at Guatemala City and await only the completion of a few details before starting a daily service between Guatemala City and Flores, capital of the province of El Peten. This line will cover a distance of only 250 miles. Why, then, is it so significant?

Consider the general physical characteristics of Guatemala. Guatemala has an area of 48,290 square miles and a population of about 2,250,000. It is the northern state of Central America, has Mexico for its neighbor on the north and west, Honduras and Salvador on the east and south and the Pacific Ocean on the southwest. A range of mountains containing many volcanic peaks runs from northwest to southeast near the Pacific. The narrow western slope is well watered, fertile and the most densely populated part of the republic. It is about the size of Louisiana.

The broad eastern slope is sparsely settled and its chief commercial importance is the production of bananas and timber and chicle in the Peten district. Coffee and sugar are the chief crops. Though rich in mineral resources little is mined owing to lack of support. Guatemala has about 485 miles of railroads, yet to travel the 250 (airmile) miles from Guatemala City to Flores requires a journey varying from 10 to 20 days. On this one must travel through British Honduras.

And now the 20-day trip will be reduced to three hours through the simple expedient of three American monoplanes. Later these planes will go into the additional service of an airmail and passenger route between Guatemala and Salvador. This opens a new era for aviation in Central America. It represents a new governmental point of view for the Guatemalan officials. Instead of purchasing additional military craft,

Three Ryan planes for Guatemala mail service.

they have turned toward civil planes for peace purposes.

In the past Central and South American countries have been interested only in equipping their armies with military planes, disregarding the importance of advancing commercial aviation. It might be remarked without fear of contradiction that Col. Lindbergh's flight to Central America is responsible for this awakening of interest in commercial aviation and this further step toward guaranteeing peace among the countries of the western hemisphere.

Flying in Guatemala is not what a United States flyer would expect to find. For instance, one finds himself flying among many volcanoes, which range in altitude from 4,000 feet to 13,000 feet. Due to the formation and configuration of the ground the laying out of railroad lines between two distant points has been a practical impossibility considering the immense sums required for financing and operation. As a result, provinces like Peten in the northeast are entirely isolated, not only from the capital, Guatemala City, but also from other departments as well.

Possibly it would be well to illustrate the difficulties of the Guatemala City-Flores journey in somewhat greater detail. The only available transportation for this trip is found through British Honduras and then by way of the Mexican southern railroad lines. These make a detour of several hundred miles and thus cause an unnecessarily long ride. Also, there are several points in the country which cannot be reached by rail, or even on horse, due to the many precipitous cliffs and steep grades. Aviation is the only solution.

The route to be opened with the three planes now ready to take to the air, between Guatemala City and Flores, will pass over the region of Baja and Alta Verapaz, a most progressive region containing 12,000 square kilometers of important coffee plantations. The planes will carry passengers, mail, dry goods and—this is very important to note—coined money.

(left to right) Colonel Granados, Mr. Zuniga, and Lt. Col. Diaz.

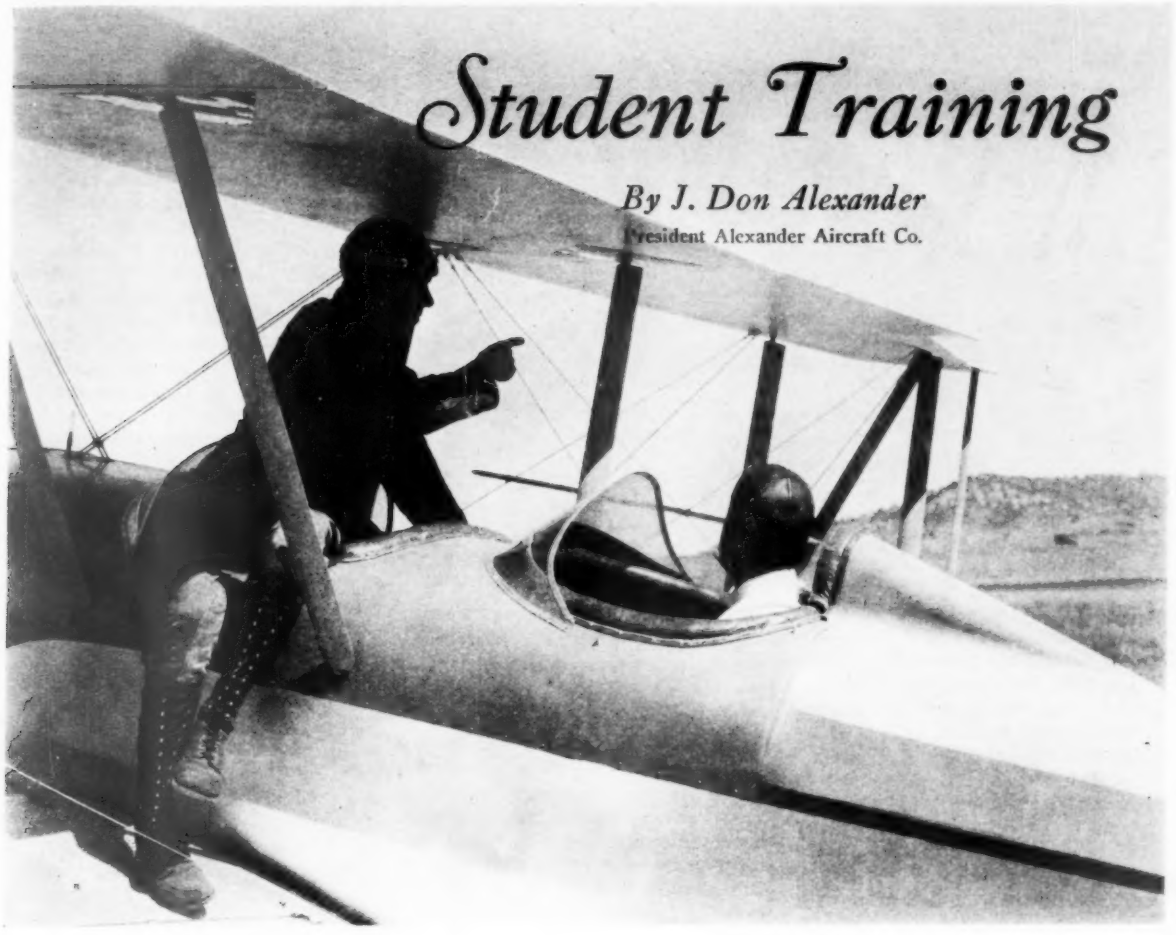
Flores has no banks. As a result credits are difficult and exchanges of money between Flores and Guatemala City are made by sending them along the circuitous route already mentioned. Money so transferred thus has to pass through two other countries before reaching its destination and from two to three weeks are lost in its transmission.

Guatemalans as individuals, as well as the officials, are "sold" on aviation. A public subscription raised the $40,000 in gold necessary to purchase the three planes that will fly the Guatemalan air mail. And two military pilots—Col. M. Garcia Granados, chief of the army air service, and Lieut. Col. J. Rodriguez Diaz—will turn from their military pursuits to the task of carrying the mail, and other things.

Once the practicability of the first route is proved, the route between Salvador and Puerto Barrios will be opened, for it will permit mail and passengers from the capital of the former to reach the port on the Caribbean Sea within four or five hours. It now takes at least two days for the trip. It should be noted that Salvador lies south of Guatemala and has no port on the Caribbean; her coast line extends along the Pacific. Most mail and passengers intended for eastern United States and Europe perforce, go through the Panama canal to reach their destination.

From strictly a flying point of view, aviation in Guatemala is a

(*Continued on page* 119)



Student Training

By J. Don Alexander

President Alexander Aircraft Co.

ALL established manufacturers now realize that the biggest problem in the development of commercial aviation is not the efficiency of the airplane, the establishment of airports or landing fields, but is the pilot. It is very easily seen why when we consider that an airplane can be built in a few hours, but the training of a skillful transport pilot takes a year or more. It is much easier to increase production facilities to build more airplanes than to create training facilities to train more pilots.

The problem is not so much the soloing of a student in from five to ten hours instruction, but the big problem is where do we go from there. The making of a real pilot involves advanced training, cross country flying and other subjects necessary to successfully maneuver a ship in difficult and unexpected conditions, the understanding of various weather and altitude conditions and their effect on the ship in the air and on the ground. In other words the most important item is the "follow-through" as in the golf stroke.

We find in actual experience that a great many students after learning to solo consider themselves good and commence to take risks in the air with passengers, quite frequently far beyond their ability as flyers. The result is that many good airplanes and good bones are cracked up. This is the real holdback in the development of aviation today. Also the lack of well-trained transport pilots is interfering with the development of a great many air-lines that would now be in operation if this country had a sufficient supply of reliable pilots.

J. Don Alexander—President, Alexander Aircraft Company.

For various reasons the man with the idea in view of becoming a pilot seeks as in any other employment where there is an element of hazard, insurance—and that insurance at a nominal premium per annum. Insurance rates are determined by the percentage of claims or accidents to volume of business signed by the insurance company. Naturally, inefficient piloting raises the number of accidents thus automatically increasing insurance rates.

The reason for the present high rate of insurance may easily be seen

in the U. S. Department of Commerce figures for the past year. We are informed that there were a total of 165 fatal accidents and that *132 accidents were to ships being piloted by unlicensed men.*

As long as the industry turns ships over to partially trained pilots a comparative number of fatal crack-ups can be expected and a resultant high rate of insurance remain in vogue; a discouraging condition that faces the airminded man with dependents who carefully considers all phases of airplane piloting. A condition that holds him back and in turn holds back aviation.

The manufacturer's attitude towards the flying school is or should be one of encouragement, but it is extremely difficult to actually conduct a flying school while he has so many thousands of problems of his own involved in the manufacture and distribution of his product. School work is a specialty in itself and for that reason many manufacturers like the Alexander Industries who started to introduce their product and conduct schools, have discontinued their flying schools in favor of school specialists and are devoting their whole time to design, manufacture and distribution.

One of the solutions which the manufacturer should encourage is the formation of more flying clubs by their distributors and dealers and the insistence that the flying clubs and flying schools sell more than instruction time up to the point of solo. There are a number of schools now that are conducted along high grade lines that do make an effort to carry instruction through to limited commercial or the transport license stage. *These are the schools that are rendering most valuable service to their students and to the industry.*

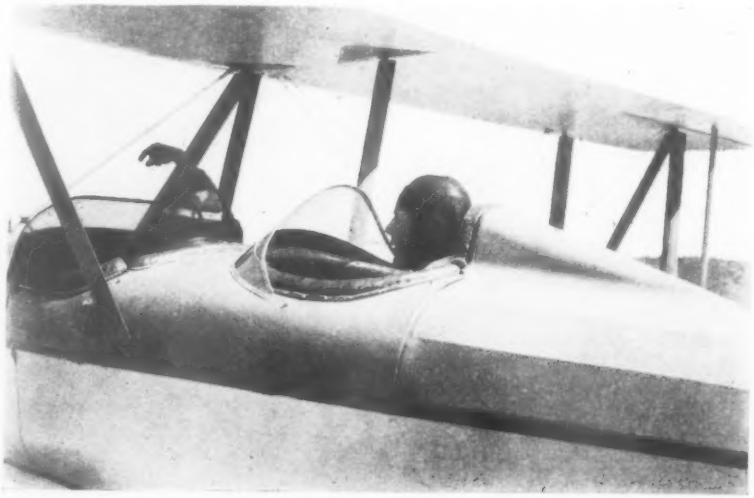
The cheap flying schools that encourage a great number of enthusiastic young men to come and deposit a small amount of money and thereby become flyers are not entirely to be censored, but rather an effort should be made on the part of those interested in aviation to reform their methods.

The mind of the prospective aviation student is extremely receptive to a conviction by the first pilot or school manager who gets to him. This youngster should be told the true seriousness of the step he is taking and should not be misled into believing that a $100 investment will get him a job as an airmail pilot with earning possibilities up into the many hundreds of dollars per month.

Many pilots learn to fly with the idea that they are going to be sales promotion managers, salesmanagers or salesmen and they go through the mechanical motions of learning to fly without any preparation of the knowledge to sell. In our experience we have found that excellent pilots are notoriously poor salesmen. I personally think that if a flying school teaches flying for the purpose of assisting their students in airplane sales work they should conduct airplane sales schools or encourage their students at the same time to take up the science of salesmanship. In our own organization we have found it very advantageous to supply our distributors, dealers and salesmen with our own specially prepared course of specialty selling.

The Commercial Airplane Manufacturers Section of the Aeronautical Chamber of Commerce, although recently founded has seriously considered getting behind or endorsing flying schools and is working out various means of rendering assistance to such schools as will adopt real pilot building methods. It has been found that approximately three out of every ten students graduated purchased a ship within a year and six out of ten in two years. The rest can be looked upon as eventual purchasers, for who has ever learned to drive an automobile and remained satisfied with the knowledge without automobile ownership?

There is no one in the game today quite so vitally interested in student training as is the accredited airplane manufacturer. To him any newly airminded young man can turn and receive the advice which means so much to his welfare and his future as a pilot.



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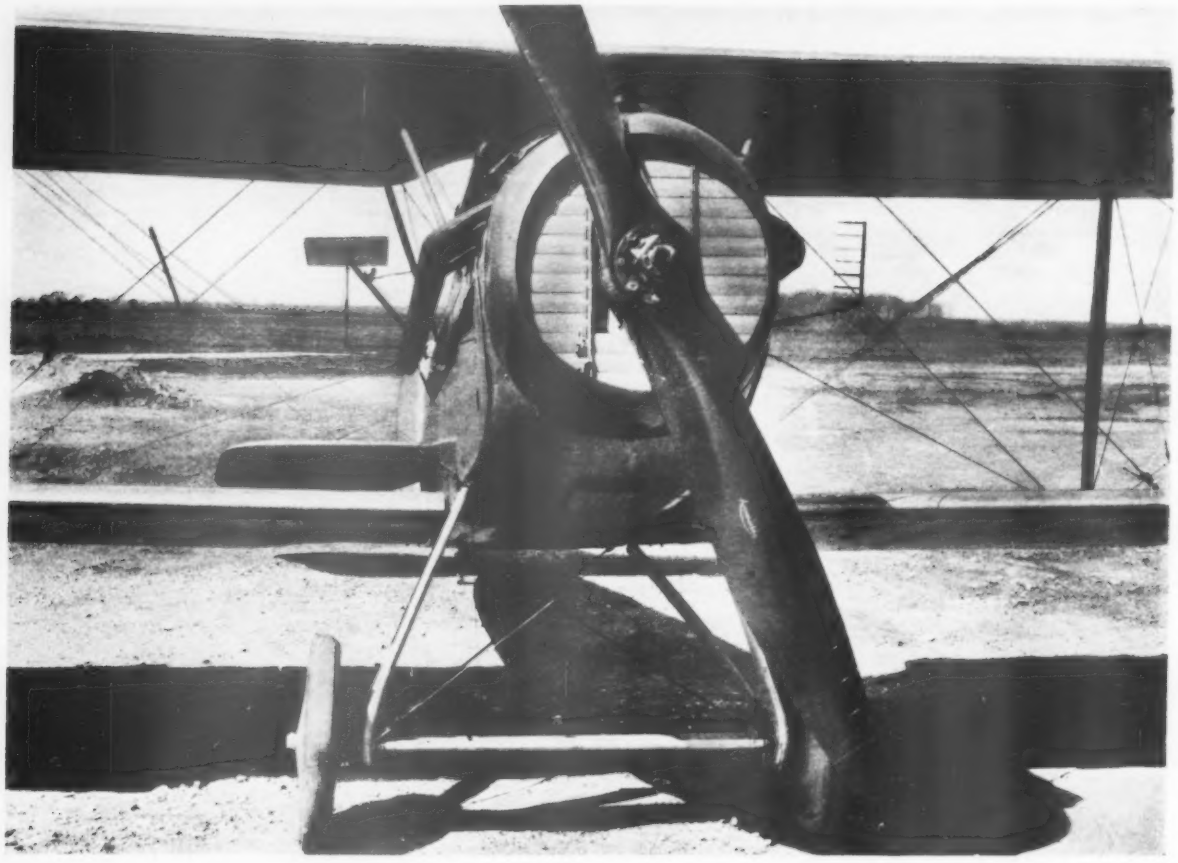

Airplane used in ice formation study.

Formation of Ice in Flight

By Thomas Carroll and Wm. H. McAvoy

Langley Memorial Aeronautical Laboratory, National Advisory Committee for Aeronautics

THE formation of ice upon the wings and other exposed parts of an airplane in flight has presented a hazard which has long been appreciated. Experiences which have been encountered during the last year have focused the attention of the aeronautical world upon it and have brought forward a demand for more definite knowledge as to the character, the causes, and the possible means of prevention of this hazard. The National Advisory Committee for Aeronautics, at the request of the Army and Navy, is co-ordinating and gathering all the information in regard to actual accidental experiences and further, has with some success, sought and examined the phenomenon experimentally.

Information which has been obtained from a large number of pilots who have encountered this ice formation identifies the conditions as follows: A condition of high humidity, usually heavy fog which, more often in the form of clouds, either broken cumulus clouds, strata formation, or a condition of actual rain, must be encountered at a temperature not more than a degree or two below the freezing point, 32 deg. F. The formation of ice has been reported by some at temperatures considerably below 32 deg. F., but these reports, in view of a preponderance of evidence as well as definite experimental data, appear to be of a secondary condition which in formation and in consequence are considerably different from the condition encountered at or near 32 deg. F.

These many reports, which come in the greatest numbers from air mail pilots who, by the nature of their work, are forced into or through conditions similar to those described above, indicate the DH-4 airplane, either on account of its more extensive use or possibly on account of a peculiar susceptibility to the conditions, has encountered the phenomenon more often. The element of greater susceptibility appears to be confirmed by the first evidences of ice formation appearing upon round wires with which this airplane is equipped. The increase in frontal area and consequent increase in parasite resistance and the consequences thereof are discussed later in this article.

When an airplane encounters rain or heavy fog at a temperature of 32 deg. F., minus only one or two degrees, the conditions are ideal for the formation of ice. The ice forms rapidly and the continuation of its formation is dependent only upon the

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maintenance of the conditions, with an almost certain reduction in flying efficiency which eventuates in a forced landing within a period of time which is only dependent upon the prevalence of the conditions, probably in no case longer than one hour, while in other cases where the conditions of high water content of the air, a temperature just below freezing and an already overloaded condition of the airplane, a lapse of only fifteen or twenty minutes would be sufficient to force the airplane down.

A condition is possible, though probably less frequent, in which a warmer stratum of air is found at an altitude higher than that at which the airplane is flying and from which rain falls into a lower stratum of lower temperature, 32 deg. F., or less, within which the airplane is flying. The consequences of these conditions are practically the same as in the other more general case.

It is generally reported that the formation of ice under the ideal conditions which are mentioned above appears first upon wires, the forward edge of struts and the leading edge of wings accompanied only slightly less frequently by similar formations on the leading edge of the propeller blades and upon the bosses of the propeller and finally upon the fuselage itself and the tail surfaces, although it is highly probable that the formation upon the tail surfaces is almost coincidental with that upon wings.

The amount of the formation appears to be entirely dependent upon the extent of the conditions necessary to form ice and the time in which they prevail. Reports vary in regard to this amount through a range of from a thin film to a thickness of three or four inches, the latter condition being considered somewhat exaggerated. Authentic and reasonable reports of up to three-quarters of an inch thickness on the leading edge of wings and struts are found and are felt to be the reasonable consequences of a reasonable length of time under the conditions as above set forth. The shapes of these formations are most generally reported as a shell or crown of ice formed at or near the entering edge and tapering off rapidly to no more than a relatively thin film accompanied in many cases by secondary formation of fringe-like icicles along the trailing edge of the wing.

In order to study experimentally the conditions and their consequences, the National Advisory Committee for Aeronautics equipped an airplane with small auxiliary surfaces and aerodynamic shapes similar to struts, wires, Pitot heads, etc., for the study. This airplane was flown to an altitude where a temperature of 32 deg. F. was encountered, at such times as cloud formations could be found at the coincident altitude. Here it was discovered that ice formed rapidly in conformity with reported experiences, in regard to quantity, character, shape and rapidity of formation.

An examination of these confirmatory data indicates that the weight of ice collected can very possibly be sufficient to force the airplane to rapidly lose altitude on account of the increased loads, but it is more readily evident that the malformation of the aerodynamic shapes may so increase the drag and reduce the lift as to produce a loss of altitude even greater in consequence, the combination of the two working in the same direction having a double effect.

No one knows how many of the Trans-Atlantic flyers who perished came to their end because of ice forming on the wings—but the subject is one that is attracting the attention of scientists and solutions are being sought for this condition.

It is obvious that an airplane simliar to the DH-4, which has high parasite resistance, is more susceptible to the conditions than would be a pure cantilever monoplane type in which parasite resistance is at a minimum, the increase being due to the malformation of the aerodynamic shapes of the parasite resistance. It is possible that angle of attack and flight speed may have some effect upon the rapidity with which ice forms. It appears, however, that this is small.

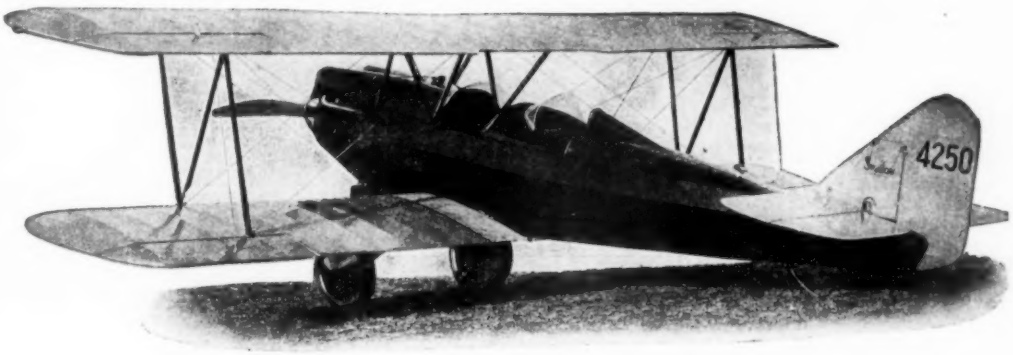
The loss of instrument operation due to clogging of air speed lines and the Venturi of the bank and turn indicator, etc., with ice is a coincident, and serious hazard, since on account of the nature of the aerological conditions, instrument directed flight is necessary to maintain a course. The interference to the funtioning of the control surfaces by freezing or clogging of control hinges or exposed pulleys is possible, although no definite or considerable amount of evidence has been presented of this occurrence. It appears certain that the continuation of the flight would be impeded by the other cases before this interference in control would become important.

That ice may form upon the propeller while in flight is definitely established. This is substantiated by reliable reports, although it has not been observed in the experiments at Langley Field. The amounts of ice deposited on the propeller are varying in thickness, but it is certain that under some conditions they may envelop not only the blade tip, but even include the propeller boss or spinner where irregular deposits have been observed.

It has been thought that the centrifugal force would serve to offset any tendency toward deposit upon the propeller, but this is apparently erroneous and the explanation has been advanced that it is due to the instantaneous nature of the formation, which is accounted for by the fact that water in the liquid stage may be encountered in the air at temperatures lower than the normal freezing point. This phenomenon is permitted by the fact that the small droplets of water are under considerable pressure due to the surface tension of the liquid, the temperature then being below the freezing point. Immediately the surface tension is broken by striking the parts of the airplane, the transition to the solid state is instantaneous. Indeed, this may be the solution of the phenomenon insofar as the irregular shape of the deposit upon the wings and other surfaces is concerned, the transition being so rapid as to prevent the water in its fluid state from following a streamline shape and producing the irregular "mushroom" shapes which have been observed.

In the flights which have been made by the National Advisory Committee for Aeronautics, conditions of a different nature with different consequences have also been encountered. These, in general, constitute a condition of clouds at temperatures 10 deg., or more, below 32 deg. F. In these conditions the formation of ice was again found, similar in some ways, but in general very different from the conditions at 32 deg. F. This appears as a formation of softer ice or snow, along the leading edges of the exposed parts. The quantity is considerably less, as there appears to be less adherence to the parts of the airplane, and the action of the wind appears to not only cut them down in quantity, but also to form a better streamline shape which has

(*Continued on page* 111)



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From Picks to Props

Great Lakes Naval Training Station from the air.

By Ensign Bilge
Naval Reserve Air Training

NOTICE—The speakers today are two officers of the United States Naval Air Service. Subject—"Naval Aviation."

This notice appeared on the bulletin board of the chapel of a small college in northern Illinois on a rainy day in April, 1924 B. L. (before Lindbergh). The first speaker, Lt. G. R. Fitzgerald, a tall, dark, handsome young man, began with the words, "The Naval Reserve offers to those men who have had at least two years of college education a commission as Ensign in the Naval Reserve Air forces." From that moment my eyes were riveted on both officers, on the gold braid of their uniforms, and most of all on the gold wings they wore over their left breast pocket.

From the time I was old enough to walk, and to find myself frequently falling down stairs and out of trees, my ambition was to have a pair of wings. I admired the graceful soaring of the gulls at the beach, I envied the speed of the swallow, I aspired to build a kite big enough to carry me to the clouds. In later years when the airplane came into its own I wanted to learn to fly.

My career in aviation began when as a boy of eleven, with utmost secrecy and grim determination, two chums and myself, partners in everything including practical jokes, devilry, and an old tent, began the manufacture of a parachute. This chute, had it been successful, would have made aviation safe for a fellow who would take an airplane provided he could keep one foot on the ground.

After a week of preparation we kids were ready to test out our new parachute. It was a bright Saturday morning, before an audience of eleven of the neighboring "brats," each of whom had paid the two cents admission fee, I was perched on the peak of a twenty-five foot barn ready to jump. It was no doubt fortunate that we could not find a higher place from which to jump, because due to the fact that the chute was made from a 12 oz. duck tent and pieces of the neighborhood clothes line, it descended nearly as fast as I did. However, I escaped with a sprained ankle and minor bruises, the bruises due to the imprint of father's slipper, size 10. Undaunted by this successful failure we began the construction of model airplanes, one of which sailed gracefully through Mrs. DeMars' window to a three point landing in a pan of dough. Now Mr. DeMar, a particular sort of person, objected to having ground glass in his bread, and reported the incident through official channels, resulting in my being confined to my room without supper. But as Dad says, "boys will be boys," and little did he realize that in seven years his boy was to be an aviator.

The second speaker at that college assembly closed with these words, "We will be glad to talk personally with those of you who might be interested in being commissioned as officers in the Naval Reserve Air Forces."

"We are both crazy as hell," said Goofy, sitting next to me, "let's us go up and talk to them."

"Okay," I replied. "This is just the opportunity I've been looking for."

Needless to say we spent the next hour in conference with the gold braid, much to the satisfaction of a history prof who had an uncanny weakness for disliking a student who snored in his lecture room. I never could sleep soundly in an academic chair, as it reminds me of a Thompson restaurant.

The Naval Air Station at Great Lakes, Ill., is situated on a sandy

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MINNEAPOLIS

stretch of beach at the base of a cliff which is nearly one hundred feet high. Besides three hangars, then bearing their camouflage war paint, there was a small shack used for an office and storeroom. It was in this shack that three of us found ourselves, one morning in May, 1924 B. L., being sworn in as Seamen, 2nd class, for a period of four years. No—we were sober and our objects and purposes were entirely premeditated. We had entered into what our officers told us was a gentleman's agreement. We were to enlist as Seamen, 2nd class, in the Reserve for four years, but as soon as we had successfully passed the ground school work and the required flight tests we would probably be given a professional examination for commission as Ensign USNR. There is nothing much lower than a Sea2c, in rank, I mean, and it was not long b e f o r e we were confident that *nothing* was any lower. Our class was the first to be trained and the whole project at that time was unorganized. Through the efforts of such officers as Captain Train, the late Noel Davis, and his successor, Lt. Comdr. H. W. Scofield, the training of Naval Reserve aviators has developed into a highly organized and efficient organization.

"Just think, maybe in a year from now we will be wearing gold braid," I said as the three of us walked out of that shack on our way to take the much dreaded flight physical examination.

"Yeah? Well, you are just a plain Gob now and they didn't promise you a thing," said Goofy.

"Well, even if we do not get our commissions we will at least learn to fly. We get paid fifty dollars a month and that's more than you ever made in your life, Goofy," said Red.

"Don't get excited. None of us have passed the flight physical exam as yet, and they say it is a knockout," I replied.

However, the Three Mosquitoes reported to the Senior Medical Officer and were found physically qualified for duties involving actual flying of air craft. Our first and most hazardous stumbling block was successfully hurdled.

"Thank God that is over," and I was expressing the sentiments of all of us. "That whirling chair made me kind of sick."

PN-10, one of the Navy's large utility and patrol planes, in flight.

"Me too. Everything is blurred. It must be due to those drops he put in our eyes for the refraction test."

"He said he thought I had hyperphoria," said Goofy, "but I told him I had never been bitten by a dog. Hyperphoria has something to do with muscle balance in the muscles of the eye. He sure laughed at me."

"He sure gets personal in that psychological exam. He asked me what I did to satisfy my sex desires, and if I ever had nightmares or walked in my sleep."

"We do not have to report until the 10th of June, that is the day school is over." I was willing to report the following day. It was hard to go back to the college and settle down to the strenuous business of studying for final exams, and that month dragged by slowly.

Time, June 10, 1924 B. L. Place, Naval Reserve Aviation Unit, Great Lakes, Ill. Scene I opens with three college fraternity men occupying center stage, all are dressed in Bluejackets' uniforms. "If mother could see her boy now in his bell bottomed panties and his little white cap. You sure are no sight for sore eyes," said Goofy.

"Well, you are no fashion plate yourself, as a sailor you'd make a good traffic cop. Who's to take my picture in this monkey suit? This will be something to tell the grandchildren about." Red was continually sneaking off to take pictures and to have his own taken, and always getting into trouble.

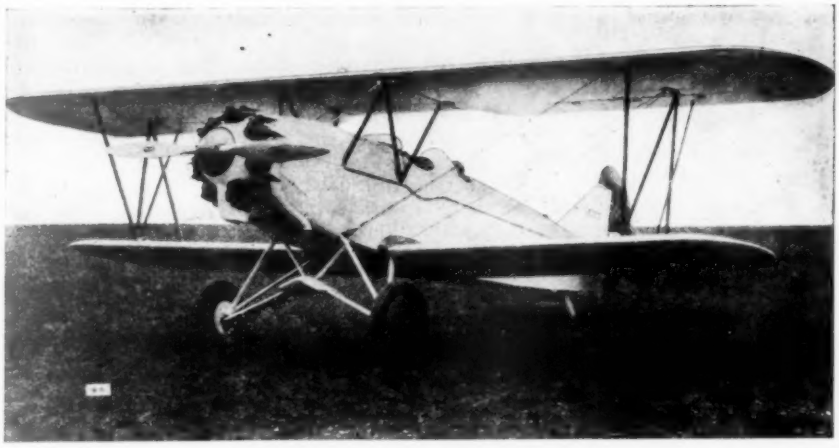
"My gosh, whatnell are you supposed to do with your hands? Thirteen buttons and these pants and no pockets. An armless pauper must have designed this outfit. There is no place to put the few things I do possess. Would you mind showing me how to tie this neckerchief before you stage your photography act?"

"There—How's that for a sea-going knot. Now give your face a rest while I take this picture."

An officer with numerous red hash marks on his sleeve walked to where we stood. "You three men who have just reported in, go to the Executive Officer immediately for assignment to an instructor and a bunk and locker." We did not question his authority, and offered an embarrassed salute.

We found the Executive Officer to be quite in sympathy with us in our predicament, that of being in a new and foreign environment. We were assigned to bunks on the U. S. S. Hawk, which at that time was tied up to the dock, these being the only quarters available at that time. The Hawk, now in use at Michigan City as a Reserve training ship, was then in a bad state of repair and our quarters were very crowded and uncomfortable. She was at one time a privately owned yacht, but was turned over to the government during the war.

The twenty of us who composed that first class occupied a compartment amidships in which there were two tiers of bunks secured to the bulkheads. The bunks being nothing more than four lengths of pipe joined in a rectangle 6 ft. 6 in. long and 3 ft. wide. A weaving of line formed the springs over which was placed



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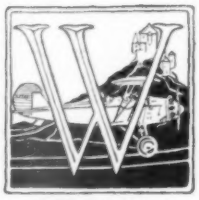

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the mattress and bed clothing. The inner edges of the bunks were hinged to the bulkheads, the outer edges being suspended from overhead by chain at either end. When not in use, which was most of the time, they were folded up against the bulkheads in order to have more room in the center of the compartment for our study tables. Poor lighting and ventilation were the chief disadvantages. It was in this crowded compartment that a majority of the ground school classes were held, and it was here we were required to do all our studying and boning for examinations.

"Rise and shine, all you sailors, rise and shine." This greeted us at 5:30 A. M. that first and following mornings, and those who were even slightly reluctant to "pile out" were practically dumped out of the unstable incentives of nightmares. We were allowed 15 minutes to rise and shine, after which came 15 minutes of physical exercises, more commonly known as monkey drill.

"Raise hands above head. Bending over and touching deck, by the number, begin, one, two, three, four," etc., etc.

"Come and get it," shouted the "big bean man from Boston," and those who did not yet understand Navy lingo were not slow to realize that this meant something to eat. There was one mad dash for the mess table only to be halted by the head ape (as we called our monkey driller) calling us back to be properly dismissed. After a lecture of unendurable length on Naval Etiquette came the command, "Leave your quarters," and the dash was even more mad.

At 6:30 we were ordered to push our squadron of training planes, consisting of three N-9s, from their hangars onto the apron in front. The N-9 is, or was, a modification of the old jenny (JN-4) and has now passed on into oblivion after having been one of the best training planes the Navy ever had. It is one of those gone but not forgotten relics and there are those fireside pilots who still love to recall their old N-9 days. The passing of the N-9, although not as spectacular as the "Passing of the Jenny," was surely as deeply felt. The N-9 was powered with a Hispano Suiza, 150 h.p. motor and had about eight feet greater wing span than the Jenny. This extra span, in the form of a center section, was required to support the additional weight of a pontoon. The controls were of the Deperdussin, or wheel type, in place of the stick, as it was thought that this type most suited the particular needs of the Navy, that of flying the more or less cumbersome seaplanes and flying boats. The planes were taken to and from the water on dollies, which were nothing more than a cradle with a caster on each corner.

"Bear a hand there. All you students over here on No. 2—one man on each wing and the rest of you push on the pontoon. All right, one—two—heave. Going out—watch your wing there, do you want to smash an aileron? Pull that left wing forward. Now all together. Whoa. That's well. Now wrap this heavy line around the casters so she won't take off while the motor is being warmed up. Bear a hand over in the other hangar to break No. 3 out."

It was no easy task for ten men to move the planes about on those unwieldy dollies, and to add to the difficulty the narrow casters would frequently break through the planks of which the apron and runway were built. The apron had been built years previously and the planks were so badly rotted that a carpenter was kept constantly busy replacing the ones that were broken by the heavy planes. The motor was always started before lowering the plane down the incline to the water so that as soon as it floated clear of the dolly the pilot could take control immediately. The speed of the planes down the runway was checked by means of all available hands holding back on a line attached to the dolly. After short instruction flights the planes would be taxied lightly onto the sandy stretch of beach, where students were exchanged and the planes serviced.

"All right," shouted the head instructor above the roar of the motors in the process of being warmed up. "The three men who have been designated to take their first instruction hop climb into the plane you have been assigned to. The rest of you stand by to lower away the planes. Take your orders from Chief Kincaid."

"Hey, lend me a pair of goggles, somebody. I left mine in my locker."

"Here's mine, but be careful with them and don't forget where you got them," I handed them up to him. "Shall I tell your girl that you were 'good to the last drop?' "

So those of us not alphabetically at the head of the list stood by enviously as three of our classmates started out on their first real instruction flight.

"You nine students" (somebody was always wanting something done) "stand by to service these planes as they come in, and the next student on the list be ready to go out immediately." Pointing out two others he said, "You two start policing up the hangars and the beach, and you," he said, designating Goofy and me, "take this pick and shovel and begin digging for the water line that is buried somewhere behind No. 1 hangar."

Goofy and I were soon to learn that this particular water line was one of the most secretive ones ever buried. In fact there were times before we actually located it that we even doubted its existence.

"Don't stand there like a statue," said Goofy, "they didn't give you that pick to manicure your nails with." He was used to a less strenuous occupation, that of jerking sodas.

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"Aw pipe down," I replied. I was not in the best of spirits due to the presence of two blisters on one hand and a sore back. "We'll dig down another foot and then have a smoke. If we sit here and throw out a shovelful of loose dirt once in a while they will think we are half way to China." We calmly proceeded to smoke.

"Do you suppose," said Goofy, inhaling his half of our cigarette, "if we locate this damn pipe line this afternoon, they will put us on the flight list tomorrow?"

"If we don't locate it pretty soon I won't be able to fly," I groaned. "Save me at least one drag on that cigarette, will you? I just offered to share it with you, not to *give* it to you."

"Were you ever up?" said Goofy, handing me the cigarette.

"Yes, I had a fifteen dollar three-minute hop with a fellow who was flying at the fair in my home town a year ago."

"I can't wait to get my hands on the stick."

"Then stick to that shovel," and we looked up into the stern face of one of the officers. "That hole has to be filled in immediately. The gas truck is coming this afternoon and will not be able to get by that dent you have made."

"Aye, aye, sir," we replied in unison.

"What is this, a game?" said Goofy when the officer had passed out of hearing. An hour later found us wiping the perspiration from our faces, thankful only for the fact that we had not dug twice as deep.

"Come and get it." At last, rest for the weary.

A northeaster had sprung up during the lunch hour, making conditions unfavorable for flying. The order came to "secure." Two men were detailed to "boots." The boots were high waisted ones suspended from the shoulders by straps and were, no doubt, intended to be waterproof. Having long since seen their best days the boots were worse than useless. The water not only entered the worn heels and toes but when an inexperienced wader found it necessary to stoop over, gallons of water would rush in around the waistline and become affectionate with the solar plexis. Bathing suits were found to be more comfortable and convenient.

The duty of the men in boots was to push the planes off the beach and to float them a distance of a hundred yards to the dollies at the foot of the runway. Securing the planes to the dollies was not a simple matter, especially in bad weather, due to the force of the wind tending to carry the plane nearly anywhere but the proper place. When it was finally secured to the dolly the motor was started and it would then be taxied up the runway under its own power, with the aid of all available hands heaving on a line secured to the dolly.

With the planes safely tucked away in the hangars we thought our work was completed for the day, but to the contrary it had only begun. We were yet to learn the real meaning of cleanliness in the Navy. Two hours later the planes were spotless, not a speck of grease or a grain of sand could be found on them. We were too tired to even try to find any.

"Seems like we have been here a month already, and the first day is still lingering on," murmured one student.

Ensign Bilge, the author of "From Picks to Props."

"Cheer up, only forty-four more days to go," said another.

"I sure am going to hit the hay right after chow," put in an optimist, but this was just an ingenuous boy's idea of the training life of a Naval Reserve aviator. The hours from seven until nine-thirty were spent delving into the technical phase of aviation in the form of three volumes of literature entitled Pensacola Ground School Manuals.

As the days went by the work became more and more strenuous, and those who grumbled or shirked soon found themselves enroute to their homes still wondering what it was all about. There were only three planes, one of which was nearly always laid up for repairs, due not to any fault of personnel, but due to the fact that our equipment was old and worn. Each student was required to have thirty hours of solo flying. The training period was forty-five days and we could not be sure of having more than two planes in operation at one time. There were days when operations had to be suspended on account of inclement weather and fog. These things necessitated our flying from sunrise until dark every day, including Saturdays and Sundays.

The class was divided into two sections, the port watch and the starboard watch. On odd numbered days the port watch would fly in the morning and have ground school in the afternoon, the starboard watch would have ground school in the morning and fly in the afternoon. The work alternated each day. Our opportunities for study came few and far apart. We were often required to work until midnight changing a damaged pontoon or overhauling motors and what not.

Exhausted as we were that first night there was no "shut eye" during the study period. The assignment was Practical Flying and Water Handling of Seaplanes. How to take an N-9 off and land on smooth or rough water. How to make turns, spirals, side-slips and skids. How to make power-stall landings. Acrobatics, how to do tail-spins, loops, falling leaf, split S turns, and most important, how to recover from a tail spin.

The most important thing I remembered that night was the little axiom:

"When in danger or in doubt,
Nose her down and kick her out."

Little did I realize that less than three weeks later I was to find myself in a tangled mass of wreckage two miles out in Lake Michigan.

"I am going to turn in and get some 'shut eye,' yawned Goofy, "and anyone contemplating suicide just try to wake me at 5:30 A. M."

"Good night, Goofy," I replied as I climbed into my bunk above him. "God, this bunk feels good. Tell the Lieutenant I'd like to have my breakfast in bed."

"Aw, pipe down and let us sleep."

Thus ended the first day.

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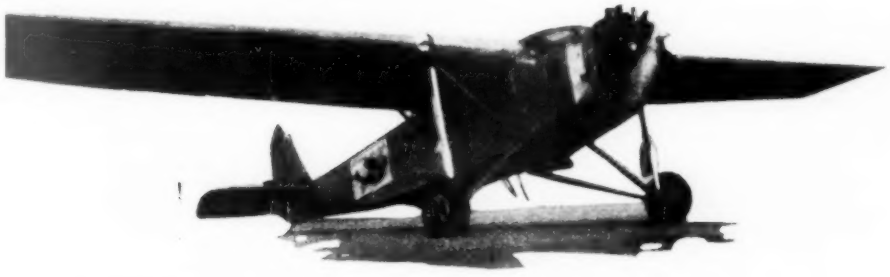

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Airplane Installment Selling

By William W. Luftig

THE financial problems arising out of the sale of merchandise on installments are primarily the problems that the finance company has to contend with in financing the dealer when purchasing merchandise from the manufacturer and in financing the consumer when purchasing the same merchandise from the dealer.

The problems of financing the sale of aeroplanes on installment are closely tied up with those of the bankers who in the last analysis actually do the financing; the dealers who sell the planes; the manufacturers who produce the planes; and the bond, insurance and trust companies which are incidentally involved. Being a specialized type of financing dealing with a comparatively new industry, it is necessary to understand aeroplanes and the merchandising problems that arise in the selling of aeroplanes, also the terms upon which the sales are to be made.

The aeroplane industry can well profit from the effective cooperative methods of the automobile industry. The manufacturer can be successful only as his dealers are successful, and the finance company can prosper only as the other two are successful. The banker is vitally interested in the methods and terms prevailing in the selling and financing of merchandise sold on installment and only as the others are doing business on a safe basis will he venture to do business with them. Without the finance company to underwrite sales, the manufacturers are handicapped in effecting quantity production of planes. The finance companies make it possible to manufacture large quantities of goods by mass production methods resulting in decreased costs to the public, and without the manufacturers there would, of course, be no goods to finance. Without dealers finance companies cannot exist, and without financing dealers cannot prosper under present conditions. Without the banks the finance companies are unable to finance large quantities of installment goods, and without the finance companies the banks would be deprived of a large remunerative means of profit. The interests of all are closely interlocked and are absolutely in common. The practices which adversely affect one will inevitably affect the others adversely. Cooperation as well as mutual understanding among these branches of an industry is vitally necessary.

As the selling of aeroplanes on installments becomes more general, the cost of the more popular models will equal that of popular priced automobiles. The practices of financing sales on time in use in the automobile industry are being followed now on a limited scale by the aeroplane industry. In general the procedure is the same and the finance company is the hub around which the sales are centered, whether it is an independent finance company or a factory owned finance company that undertakes this service.

One of the foremost aircraft manufacturers in the country has been selling planes on installment for almost two years. Their time payment plan is based on the principle of enabling a pilot to pay his deferred payments out of his earnings as a test pilot, in the delivery or passenger service, cargo carrying, exhibition, mail, photography or what not. Their planes were selling until recently, for about $2,500 and they require a minimum down payment of thirty per cent. Whereas in the automobile industry co-makers or endorsers on the notes of a purchaser are the exception, this company requires two property owners to co-sign the note with the purchaser. This requirement is intended primarily for the bankers who would not discount this type of paper unless amply protected. To the list price of the plane, there is a charge of eleven per cent added for interest, risk, selling expenses, brokerage, handling charges, financing costs, etc. This premium rules where the down payment is the thirty per cent minimum and decreases as the down payment increases. The balance, after the down payment is deducted from the selling price, is extended over ten equal monthly payments. A mortgage and a note is made by the purchaser to the dealer selling the plane, who is a distributor and not an agent of the manufacturer, and is then sold by the dealer to the manufacturer. The manufacturer then discounts these notes with his bankers.

The manufacturers of aircraft cannot very well combine the double function of manufacturing and financing. As yet their capital is limited and is used primarily for manufacturing operations. There is need for finance companies to take over the financing of both the dealer and the consumer and to leave the manufacturers to their own business.

For the finance company to underwrite the sale of new aeroplanes from the manufacturer to the dealer and also to finance the retail sale of planes to the public, requires working capital. The same sources are employed in securing this working capital as are common to any business, namely, the funds obtainable from the business itself through its stockholders and surplus earnings; the use of the banks in discounting operations; and through the placing of securities in the open investment market. The capital supplied by the stockholders who organize the finance company is the initial source from which working capital is secured. The borrowing operations undertaken depend to a considerable extent on the size of this capital. When installment selling was yet in its infancy and finance companies were small, firms with small capital were able to borrow frequently from eight to ten times their capital investment. Now the banks frown upon such practices and limit the ratio of borrowings against the capital and surplus of the finance company to not above two or two and a half times its capital investment. It is readily apparent therefore that to obtain sufficient credit to do a business consistent with the intentions of the original proprietors, the finance company must start with a large capital. It is necessary that the finance company have a large enough capital to start with, because in a tight money market, or during a period of depression with possible repossessions, the finance company will have to fall back on its original capital to tide it over. The credit line that may be established at the banks depends on the amount of capital and surplus of the finance company. A few of the larger companies dealing in automobile paper borrow from four to five times their capital, but they are special cases. The banks consider a statement showing an indebtedness of three or four times the capital investment as

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reckless business on the part of the finance company, forgetting that their own indebtedness usually averages a great deal higher ratio to capital stock than does the indebtedness of most finance companies.

A corollary source of working capital is obtained from the common method of putting back into the business a portion of the earnings in the form of surplus. This surplus acts as additional capital upon which the finance company may secure credit at the banks.

The commercial bank is the main source through which funds are obtained to carry on its financing operations. If the only funds available were those obtained by means of the two methods outlined it is doubtful if a satisfactory return could be obtained on its capital. The bank is the primary and ultimate source of securing the capital by which the aeroplane industry will be able to do business on large scale production and by which its products will be able to be sold on installments. It is estimated that ninety per cent of the credit required for the financing of installment goods is obtained from the banks. The commercial bank holds the key to the situation and is really a wholesale dealer in credit; dealing it out to the finance companies who are like retailers in credit, who in turn pass it on to dealers and installment buyers. A finance company that cannot obtain money at the bank cannot function.

The simplest method of obtaining credit is for the finance company to give the bank its own corporation single name promissory note, without any security. This method, however, is not in common use. It is through the discounting agency that the finance company and the bank meet on mutual terms. The finance company may discount its own note secured by its retail-purchaser and dealer notes receivable, or may arrange for a straight rediscount on its customers' notes. Another method is for the finance company to sell collateral trust notes to the banks and in the open market. These notes almost take the form of a bond, having interest coupons attached and maturing not later, as a rule, than in ten years. These notes and the raising of capital by direct subscription to the public afford another means of obtaining capital with which to operate the finance company.

The financing of the finance company is not the only financial problem with which installment selling has to deal. The financing of the dealer is of equal importance. If the aeroplane industry is to grow into a major industry as did the automobile, radio and other industries, it must have dealers selling its products all over the country. Mass production of aeroplanes will bring into existence thousands of dealers, and if past indications can be taken as a criterion, these dealers will be men with limited capital, their average rating for the country as a whole, probably not much above that of the average automobile dealer. It is estimated that the average rating for the automobile dealer for the country as a whole is about $7,000. As the cost of each individual item of merchandise that the dealer sells runs into considerable money, and as he is required to buy a representative quantity of merchandise due to the many styles and models, the small capital with which the average dealer conducts his business is small indeed. And if he is required to sell his wares on installment, his small capital is insufficient. It was these two definite needs that brought the finance company into existence. It serves the double purpose of aiding the dealer to buy goods from the factory and then to sell the goods on the installment plan to the public, thereby enabling him to continue in business even with a modest capital. The financing of the dealer to enable him to buy merchandise from the factory is commonly known as wholesale financing and the financing of the dealer in the sale to the consumer is known as retail financing. No finance company confines itself entirely to wholesale financing and most of them do this double financing for their dealers. Neither the manufacturers or the banks are willing to finance dealers. It is usually left to the finance company.

Installment selling was undoubtedly one of the big factors in the mass production of automobiles as it enabled hundreds of thousands to purchase machines otherwise unobtainable. The adoption of installment methods will give aviation an impetus.

The usual procedure in wholesale financing is for the manufacturer to load his product f. o. b. factory and send it to his dealer or large distributing agent with drafts attached to the bill of lading at the time of shipment. It really means that the goods are shipped to him c. o. d. The payment of the draft can be made through a local bank. Delivery of the goods is not made until the draft has been paid. When the dealer or distributor is unable to meet the draft from his own resources or through credit obtained at his bank, arrangement is made with a finance company to make payment. Upon the arrival of the goods, they are placed in a bonded warehouse and remain the property of the manufacturer until the dealer pays for them with funds advanced by the finance company. The dealer advances a small portion and the finance company advances the balance. The warehouse receipt is endorsed over to the finance company as security for the loan and the manufacturer receives the purchase price of the shipment immediately. Upon the sale of a piece of merchandise, a model of which he has on his floor, the dealer obtains the necessary access to the warehouse by permission of the finance company and removes the goods on which he has already received a deposit from the customer. As soon as the sale is consummated, the dealer turns over to the finance company the portion owing to it.

Finally, we have the financial problem of the consumer. In the automobile industry—and we must always turn to this industry as it is the leader in installment selling—between sixty-five and seventy-five per cent of all automobiles are sold on credit to the ultimate consumer. The dealer is unable, because of his limited capital, to undertake the burden of carrying the installment obligations of his customers. Aside from the inability of the dealer to carry his customer's notes, the dealer of installment goods is usually not prepared by training or equipment to carry out the credit and collection functions of the finance company. He has not the necessary machinery to make a thorough investigation of the credit of the buyer, neither has he the bookkeeping and collection systems with which to follow up his accounts. The ready means for repossession and the following up of insurance claims is lacking. The handling of installment accounts is a nuisance to the dealer and the cost of handling this business would not warrant the charge obtained for the financing. The finance company has many hundreds of accounts and a few losses do not affect its finanical condition, whereas one or two losses to the average dealer would probably mean placing him in financial difficulties. The desire of the dealer to make a

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sale would affect his judgment as to the risk of the buyer, with the probability of tempting him to sell his wares to poor credit risks in order to increase his sales. The close follow-up of collections or the possible repossession of the goods would but antagonize the customer and would result in the loss of a customer for resales. The finance company relieves the dealer of all the details incidental to financing, permits him the full use of his capital and does not limit his field of operation.

The difference between wholesale and retail financing is only one of detail. When the dealer buys goods from the factory the manufacturer is assured of his money at once—a small percentage from the dealer and the remainder from the finance company. The same condition applies in the case of retail financing, except that the consumer pays a certain per cent down to the dealer and the finance company pays the dealer the balance of the sales price. The dealer receives one hundred per cent cash immediately, which includes his full profit on the sale. The buyer gives a lien on the goods bought as security on the balance paid by the finance company, and signs a note calling for payments spread over a number of months. The note is made payable direct to the finance company or to the dealer and by him assigned to the company.

In the retail financing field, the manufacturer is endeavoring to wrest control from the finance company by having a factory company do the financing. They want to reduce the cost of the goods to the buyer to the lowest possible figure. Finance charges and insurance expenses enter into the cost of financing and the manufacturer is making an onslaught on this particular phase of the cost. From the viewpoint of the manufacturer, financing is only a means of placing merchandise in the hands of buyers. By doing the financing themselves, they obtain control over the finance costs. To the argument advanced by other companies that the manufacturer should not unite both manufacturing and financing, the reply is that as financing is only a service, the manufacturer is just as capable of performing this service as any finance company, and that there is no reason for divorcing one from the other. It gives him a greater supervision of the risks; places the control of sales in his hands; permits the use of surplus funds for financing operations and brings the goods to the buyer at a lower finance cost.

Aviation Training

By Donald E. Kehoe

Aeronautics Branch, Department of Commerce

THE rapid progress of aeronautics and the natural increase of public interest, particularly in aviation, has aroused a widespread desire for entrance into this field of employment. As in every other industry, there are openings for trained men of experience, but the peculiar requirements of aviation are such that the most careful consideration should be given before a selection of a special phase is made.

Some of the positions which may be obtained after proper training and experience are as follows:

1. Pilot.
2. Mechanic.
3. Aeronautical engineer (airplane and engine design).
4. Factory man.
5. Airport designer and constructor.
6. Airport ground man (helper).
7. Radio operator (airport or airplane).
8. Traffic agent.
9. Advertising and publicity man.
10. Salesman.

There are other positions of extremely specialized or executive nature, but, as a rule, training in one or more of the branches indicated will fit men for such positions.

The question of openings in these phases of aviation is one that cannot be answered definitely. A variety of factors must be considered as in any other business.

A pilot with several hundred hours of experience in all kinds of flying, including cross-country work and night and fog operations, will obviously be more valuable to a transport company than one who has had less time in the air and whose experience has been gained at airports alone.

However, this is not to be taken as an indication that there is no place for the pilot with less flying time and experience. The Department of Commerce recognizes this by granting limited commercial licenses to pilots with 50 hours solo flying time. These licenses authorize their holders to carry passengers for hire within a restricted area around an airport. An industrial license is granted for the same amount of flying time. This permits a pilot to engage for flying for hire in certain operations, such as cotton dusting, aerial photography, etc., but not to carry passengers or property for hire between states.

The Air Commerce Regulations should be carefully studied to obtain full knowledge of the qualifications and privilege of licensed pilots.

The ability of the individual is always a governing factor, but the deciding factor is, of course, the state of the industry. No attempt can be made to estimate this closely.

Pay for pilots varies. On most contract mail routes pilots receive a base pay with a percentage for miles flown with mail. Other pilots engaging in miscellaneous commercial operations may receive straight salaries or commissions. Pilots operating independently carrying passengers at airports usually receive from $2 to $5 for each passenger carried on short flights. The amount in each case usually depends upon the service performed, the locality, the method used, the equipment, and the reputation of the flying personnel.

The rule of supply and demand will always apply fully to the opportunities for employment as a pilot.

Good airplane and engine mechanics are usually in demand, especially those that have a detailed practical knowledge of airplane rigging and repair and engine operation, maintenance and overhaul. Such experience cannot be obtained in a short time nor by theoretical application, but must be acquired by combining theory with hours of practice under service conditions. The department requires that applicants for mechan-

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AIRPLANE Mechanics and Engine Experts Needed!

WE have just promised to furnish a $2,000,000 aircraft factory, now building right on Parks Airport, wth a minimum of 200 airplane and engine mechanics by February first! Do you want one of these jobs?

Whether you want to work in St. Louis, New York or Los Angeles, the first question your employer will ask is *"Where were you trained?"*

Because only *thoroughly trained* men are wanted, and these are paid *huge salaries!*

It costs *no more* to learn to build wings fuselages, landing gears—to rig and service airplanes—to overhaul and install motors—in the largest civilian air school in America!

In fact, it costs less to be *thoroughly trained* than poorly trained.

In the Airplane and Engine Mechanics School of Parks Air College, we have Whirlwind, Caminez, OX5, Liberty, Hispano-Suiza, Velie and other latest motors. You tear these down, repair them, build them up, and test them.

You learn all about airplanes and engines. You actually build airplanes complete piece by piece.

You learn factory production methods; become qualified for field duty, factory jobs, foreman's and superintendent's positions!

You get field duty on the flying line where you are entrusted with the responsibility of keeping a certain number of airplanes in the air. The Parks job-way system gives you training under *actual factory and transport conditions!*

SPECIAL PRICE

There are over 130 airplane factories and over 1500 registered airports in the United States. New dealers, distributors, factories, airports are opening up *daily!* Where are all the mechanics coming from? To supply them we are offering a special rate *now* that saves you nearly half.

Get all the details. Send for a free copy of "The Man Who Tunes the Plane," our Mechanics School catalog, that gives you full particulars of the course, shows photos of students learning to build and service airplanes and engines, and gives you full details of how you can save $105 on the price of this great Airplane and Engine Mechanics Course.

Don't let this opportunity slip by! Wire at once for this free catalog or send the coupon by airmail today! This offer may never be repeated!

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AFFILIATED WITH PARKS-AIRLINES-INC.

MOST ELABORATELY EQUIPPED AIR SCHOOL IN AMERICA

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Parks Air College, Inc.,
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☐ I enclose $25 deposit on the $195 rate for the regular $300 Advanced Ground Course.

☐ Send me "The Man Who Tunes the Plane."

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ics' licenses shall have had at least two years' experience on internal combustion engines, one year of which must have been on aircraft engines.

As the industry grows, good aeronautical engineers will always be needed, as will manufacturing experts and shopmen, but here, as in other phases, special training must be acquired.

The airport designer is a specialist of a different sort. He should possess a thorough knowledge of flying in order to see proposed airport sites as with the eyes of a pilot. Assuming this experience and basic engineering education, and sufficient study of airports and their peculiar engineering problems, the airport specialist will have the foundation for obtaining a valuable place in the industry.

Airport ground men, as discussed here, do not include executives, traffic men, etc., but are usually helpers with ordinary experience and no special training. Their chances for advancement depend upon themselves and the agreements which they have with their employers. These ground men usually perform miscellaneous work without engaging in actual flying.

The positions of traffic agent, advertising and publicity man and salesman all require a working knowledge of flying combined with some special talent for the particular work chosen. Such opportunities will increase with the growth of the industry, but probably these men will be recruited from the ranks of pilots who have found that their special abilities along these lines outweigh the advantages of continuing in piloting alone.

The executives of aviation will necessarily be chosen from those combining knowledge and experience in several of the more important of these phases.

The opportunities in the Government service can be more specially outlined. Enlistment in the Army, Navy, Marine Corps and Coast Guard for aviation duty will usually afford some chances of close contact with flying, but the services do not usually provide actual flight training in the case of ordinary enlistment. Appointment to one of the Army cadet schools will give the student a chance to complete a very thorough course as a cadet, after which he will be commissioned as a second lieutenant in the Air Corps Reserve and will ordinarily be put on inactive duty. He can then take up work in commercial aviation if he so desires. Details as to this course can be obtained from the Chief of the Army Air Corps, Munitions Building, Washington, D. C., which office also dispenses information in regard to enlistment in the regular service of the Air Corps.

The matter of entering the Naval Reserve Force is covered in Circular No. 803-19, issued by the Bureau of Aeronautics, Navy Department.

Details of enlistment in the Navy, Marine Corps and Coast Guard may be obtained, respectively, from the Bureau of Aeronautics, Navy Department, Marine Corps Headquarters, Navy Building, and the Coast Guard, Treasury Department, all of Washington, D. C.

Methods of Acquiring Training and Experience

The usual plan in this case is to obtain instruction at one of the commercial flying schools in the country. There are several hundreds of these now listed in the Aeronautics Trade Directory of the Department of Commerce, but the department has not established a rating system for these schools. Suggestions as to comparing the courses offered and deciding which school would offer the best results are contained in another section of this bulletin.

Mr. Kehoe's article is a safe and sane summary of the present possibilities in aviation, particularly from the standpoint of the young man who is seeking a career.

Another system of learning to fly is becoming more and more popular in this country. This is the flying-club method. Members of flying clubs usually include men and women who are unable to purchase planes independently and to hire instructors to train them. They also include those who are unable to spend several months at training schools and who have only a few hours each week in which to receive instruction. Suggestions for organizing flying clubs are contained in a later section.

The military and naval services offer opportunities for acquiring training and experience as previously outlined.

A recognized method of securing experience as an aeronautical engineer is to attend a college or university with a complete course in aeronautical engineering. Graduates of these schools should supplement their theoretical and laboratory training with certain practical experience before they are ready to take up regular engineering work.

The manufacture of airplanes and airplane engines is a specialized field. Designers and constructors are ordinarily taken from the ranks of recognized aeronautical engineers. Factory riggers and mechanics are usually those who have obtained experience in rigging at commercial airports or in the military and naval services. Welders who are now used in building steel tubing fuselages usually are employed for their welding ability rather than for aeronautical training. Some factory men begin as helpers in order to learn this trade and acquire experience in the same manner as in any other factory.

The airport designer, as previously described, must combine engineering experience with practical knowledge of flying. Steel construction experts find their training valuable in hangar work. Road builders may find opportunities in the construction of runways. There is need for men with electrical knowledge to install and maintain lighting systems at airports.

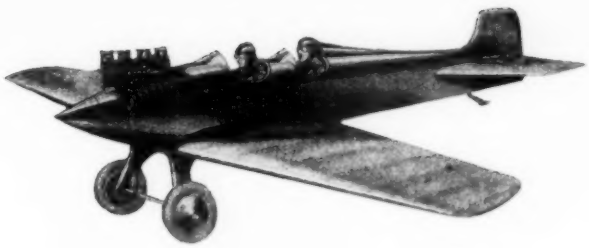
The airport designer and constructor is a man who has a fair knowledge of all these phases, and in addition an understanding of meteorological conditions so that he may choose good sites for the airports he builds.

Traffic agents, advertising and publicity men, and airplane salesmen usually have previous experience in one of the three lines indicated besides a fair knowledge of aviation in general. Perhaps the best way to work into these positions is to enter one of the other branches of the industry and later to specialize along the desired line.

Choosing the Training School

Before enrolling the student should take the physical examination which is required before this department can issue a student permit for instruction in licensed planes. The air commerce regulations prohibit instruction in licensed planes without such a permit, so that before going any further the prospective student should not fail to assure himself that he is physically qualified.

The names of the proper physicians designated as examiners by the department can be secured from local flying schools and airports, or upon application to the Medical Director, Aeronautics Branch, De-



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The Guardian is rugged, powerful, safe. Its design is simplified. It has a safety factor of 8! It is the simplest and lowest-powered practical airplane in America.

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It has been especially designed so it can be built by any mechanically inclined young man who will follow the instructions and plans furnished.

Think of building an airplane yourself from easy-to-understand plans prepared by a graduate aeronautical engineer with 12 years' experience! Think of equipping this with a low powered engine and flying it yourself! Think of an airplane strong enough for stunting, with a ceiling of over 10,000 feet, a speed of over 80 miles an hour—that you can build yourself for only a few hundred dollars!

Complete Plans $5.00

We want a thousand Guardians built and flying by spring. Spend the next month or so constructing one! It's easy. Send $5.00 *today* for a complete set of working drawings showing all details and dimensions by this practical two-seater lightplane, together with full instructions for building it, a recommended list of the kinds and types of motors you can get cheaply to install in it, suggestions as to obtaining 50 or 200 hours flying time for a Commercial or Transport license, and a plan for forming a Lightplane Club.

You can build it in a few weeks at home with a few simple tools. The Guardian has a modern steel tube fuselage and simple, strong fittings especially designed for the amateur builder. You can build a Guardian complete, and get in enough flying time for a license, for a small fraction of the cost of attending a flying school! Send $5.00 *now* for a complete set of plans and all particulars, and get started before your friends beat you to it! Satisfaction guaranteed!

Send Your Order Today!

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SPECIFICATIONS

Span: 28 feet.
Length: 19 feet.
Weight Empty: 400 lbs.
Top Speed: 85 m.p.h.
Landing Speed: 32 m.p.h.
Capacity: Pilot and Passenger.
Type: Monoplane.
Power: As a single-seater, 20 H. P.
As a 2-seater, 35-40 H. P.
Dual Control if desired.

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Now is the time to get started building. You can put in time for a Commercial License, have hours of fun and sport flying yourself and carrying your friends. You can fly cross-country and make money in aviation.

Be the first in your district to build and fly this sensational monoplane. *For the first purchaser of plans in each town* we have a special offer to represent us with a discount on all later plans, parts and supplies sold to other builders. Send your order today and get your ship in the air in time to make big money on this flood of Lightplane business that is beginning to sweep the country. Mail your order at once!

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partment of Commerce, Washington, D. C.

In order to choose the training school which is best suited to his needs, the prospective student should make a careful study before deciding on any one organization.

If he resides near enough to any training school under consideration, he should visit it and observe the method of its operation. He should know what equipment it has for training its students and he should learn how many students are assigned to one pilot and one plane for instruction. Too many students assigned to one instructor will extend the period of instruction over an undesirably long period.

The prospective student should talk with the students and learn whether they are satisfied with the results they are obtaining. If possible, he should talk with pilots who have graduated from the school and should know whether they are steadily employed or successfully operating planes of their own.

He should study the course offered, both the theoretical and the flight instruction, and should compare this with courses offered by other schools. Particularly, the student should find out definitely what guarantee there is that he will be given flight instruction and in what period of time his training will be completed. If the wording of the contract or guarantee is not clear on this point, he should have it interpreted by some disinterested person.

To sum up, he should determine whether the school is run systematically, whether the students are satisfied, and whether there is sufficient evidence that the advertised course will be given as indicated.

If the student does not live close enough to the school or schools under consideration, he should write for full details of the courses offered. These may be compared and if they are not sufficiently clear, the student should correspond further and insist on definite answers to questions which are in doubt.

It would be in order to correspond with graduates, if possible, learning where they are employed for the purpose of determining whether they have succeeded on the basis of the instruction given by the school attended.

If there is difficulty in obtaining any of this information, particularly in case the student is not able to visit the school, he may write to the chamber of commerce of the city concerned or to the Better Business Bureau of the city for an expression of opinion as to the merits of the organization being considered.

The Department of Commerce has not established a rating system by which these schools can be compared, and this may not be done for some time in the future. However, one aid which the department offers as a guide is its air commerce regulations. The better flying schools conform gladly with these regulations and they prepare their graduates for at least a private pilot's license, in addition to furnishing the ground work which will enable them to pass the examinations for higher licenses. The air commerce regulations should be studied carefully by students before entering commercial schools, so that they will be fully acquainted with the requirements of the department and can judge whether the school concerned can qualify them for these licenses.

The average training school gives 10 hours of dual instruction and one or two solo flights. The student who completes this training is by no means ready to enter the industry as a trained pilot. He is equipped merely to continue solo practice. He should be in a position to continue flying regularly, either by paying for practice flights, by arrangement with an operator whereby he works in exchange for training, by purchase of his own plane, or in a flying club.

Popular Aviation believes that the truth about the aviation situation will clarify matters to a large extent. Mr. Kehoe has gone into it thoroughly and the conclusions are embodied in this article.

He should not consider that he will be able to secure a position with an operator on the basis of his ability to fly alone at the end of 10 hours' training. He has only begun the aviation business and he should obtain at least 50 hours' solo experience before he attempts even the carrying of passengers at an airport. At the expiration of this period the new flyer may begin to carry passengers and thus add to his experience so that at the end of 200 hours he may be able to pass the Department of Commerce examination for a transport license.

It should be remembered that a 10-hour training period which can not be followed at once by regular practice will be of little value to the student. The method of continuing this training should be decided and ready to be put into effect before beginning the training period. Otherwise the student may have to take additional training later, on account of his first instruction having been partially forgotten.

Flying Clubs

The purpose of flying clubs is to provide a means by which men and women may be able to acquire flight training without attending a regular school. Usually these clubs are made up of members who have not the time to attend commercial schools or who are unable to purchase planes independently and pay for regular instruction.

By combining their resources, the members are able to purchase one or more planes and to hire an instructor who will teach them to fly until such time as one or more members are qualified to do this. The air commerce regulations require that instructors in licensed planes must have transport licenses.

One method followed is to sell memberships of various classifications, those with the higher classifications being authorized to use the club plane at more frequent intervals or for longer periods of time. Usually, the number of members is based on the number of planes available for use. Although the department believes that assignment of too many students to one instructor at commercial schools will be undesirable, this need not be considered so carefully at clubs where the acquisition of flight training without waste of time is not the sole aim of the members, as it is with a student at a school.

There is, however, a definite limit beyond which a high membership makes it impossible for any of the members to become proficient in piloting.

The department does not have sufficient data on which to issue full recommendations for the operation of flying clubs. This matter is being investigated and as soon as possible a more complete discussion will be made available. In the meantime the following suggested plan of operation submitted by one flying club in the United States is presented without comment for the benefit of those desiring to organize such clubs:

The tentative plans call for the purchase of one or more planes for the use of the club, the erection of a hangar in which to store the planes, and a clubhouse for the comfort and convenience of members. The method

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There is money for you in Aviation, if—you get thorough training NOW! Our courses will give you this training—they are taught under the direction of U. S. Government Licensed Transport Pilots and Mechanics and cover EVERYTHING about planes, motors, their maintenance and construction, etc. EVERYTHING a pilot or mechanic must know to secure a good paying position.

TRAINED MEN ARE NEEDED!

Aviation is the fastest growing industry in the world today—offering unlimited opportunities as a commercial pursuit and unsurpassed enjoyment if flying for pleasure alone. The beginner NOW will be the master of aviation a few years hence. There is honor and prosperity ahead for those who start NOW with the proper training and grow with the industry. Commercial aviation needs men and there is an ever increasing demand ONLY for those who have been properly trained—Von Hoffmann gives you this training. Our equipment is new and of modern design, subject to daily U. S. Government Inspection. (Most schools do not have a resident U. S. Government Inspector on the field—think what this means to you.)

PRACTICAL TRAINING--THE ONLY WAY TO BIG PAY

We teach you by actual flying and practical instruction; no long course needed. The training which the Von Hoffmann student receives is the exact training which he must have to qualify for immediate positions on the ground or in the air. Our courses have been laid out with a single object in view—to give thorough training in all branches of aviation—training that will not only enable the student to secure a good paying position upon completion of his course but also keep in pace with the constant advancement of this great industry. We guarantee sufficient hours in the air to make each student master of his ship; pilot it safely and efficiently without assistance. *No student bond required.* Our ground course gives thorough instruction in ground work and will qualify you for a position as motor or plane mechanic, rigger, electrician, welder or any ground position, or you can take the course combining ground instruction and flying which will qualify you for a private, industrial, limited commercial or transport pilot.

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If you are interested in Aviation, you should know the necessary physical qualifications and what is required by the Government for a mechanics or pilots license. Our new book, "AVIATION and YOU," tells all. Learn these vital facts.

THOROUGH INSTRUCTION AT LOW COST

The cost is low considering daily flying and thoroughness of theoretical and ground instruction on latest modern type planes, Wright Whirlwind and other standard motors.

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Write for our plan which will enable you to own your plane and secure without cost to you a complete course of instruction.

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Send me your big, new book, "AVIATION AND YOU" giving all the facts about your ground and flying courses. I assume no obligation.

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of obtaining the necessary capital for such an investment has been worked out based on the cost to purchase, maintain, and amortize the investment in one or more airplanes. The capital account will be raised by selling memberships of various classifications and the maintenance account sustained by membership dues and also from the profits derived from the use of the ship at standard commercial club rates by members or from commercial use by others at slightly higher rates.

The financial plans are as follows:

Estimated cost of first plane, $2,500.

Depreciation is estimated as follows:

50 per cent first 6 months	$1,250
25 per cent second 6 months	625
15 per cent third 6 months	375
10 per cent fourth 6 months	250
Total	$2,500

Interest on investment at 8 per cent:

First 6 months on $2,500	$ 200
Second 6 months on $1,250	100
Third 6 months on $625	50
Fourth 6 months on $250	20
Total interest charges	$ 370

Amortization (depreciation plus interest charges):

First 6 months $1,250 plus $200	$1,450
Second 6 months $625 plus $100	725
Third 6 months $375 plus $50	425
Fourth 6 months $250 plus $20	270
Total amortization charges	$2,870

Taxes.—The "tax account" can not be estimated at the present time, due to insufficient data concerning this item, but would be chargeable to overhead.

Sinking-fund provisions (amortization $2,500, plus interest, $370, plus extraordinary maintenance estimated at one-fourth of total cost of ship or one-fourth of $2,870 equals $717.50):

First 6 months at rate of $271.50 per month.

Second 6 months at rate of $150.75 per month.

Third 6 months at rate of $100.75 per month.

Fourth 6 months at rate of $75 per month.

NOTE.—Insurance will be taken out on the ship to cover any damage to the ship and damage to private property. The estimated cost of the insurance is 10 per cent of the value of the ship which in event of complete smashup will pay the club three-fourths of the original value of the ship. This item of expense is taken care of in the estimated cost of ordinary maintenance of the ship and will be explained later.

Estimated interest savings on sinking fund deposits at 4 per cent:

Starting with second 6 months, $1,450	$29.00
Third 6 months, $2,275	45.50
Fourth 6 months, $2,700	54.00
Total interest savings	$122.50

Estimated hourly cost of operating plane:

Gas, 10 gallons per hour at 27 cents per gallon	$2.70
Oil, ½ gallon per hour at $1 per gallon	.50
Labor, 15 minutes for each hour of flying at $1.25 per hour	.30
Overhead	.50
Actual cost	$4.00
Interest charges, amortization, insurance and extraordinary maintenance	1.00
Total estimated cost[1]	$5.00

[1]Subject to revision later as actual cost may warrant. Probably will be lowered, but at present estimated price the cost per mile (cruising speed 85 air-miles per hour) is only $0.058.

It will be noted that all the above items are liberal in respect to oil and gas and close on labor and overhead. However, under normal conditions labor items will be mainly limited to servicing the ships and this will be largely taken care of under the item of "overhead."

Capital account:

20 resident members at $100	$2,000
125 resident associate members at $25	3,125
10 nonresident members at $50	500
30 nonresident associate members at $12.50	375
Total capital	$6,000

Proposed expenditures:

One training plane	$1,800
One new commercial airplane	2,500
Labor expense connected with obtaining and erecting hangar and clubhouse	1,000
Total initial expenditures	$5,300
Reserve	$700

NOTE.—The training plane will be equipped with an extra heavy landing gear (modified D. H. landing gear) with large D. H. wheels and will include spare parts. The ship will be used to check up members (pilots) before permitting them to use the commercial airplane. It will also be used for dual "instruction" for beginning in primary flying training. An endeavor is being made to have the clubhouse and furnishings donated and the club will be put to only a slight expense in connection therewith.

It is proposed that the chamber of commerce, the city, and the county be asked to advance or arrange for funds with which to build a municipal hangar of sufficient size that the club ships and privately owned ships of members of the club may be stored, the amount advanced ultimately to be returned from rental charges for airplane storage.

Membership.—A resident member must be a qualified pilot. The initiation fee will be $100, which will include a free initiation flight of two hours. The dues will be $5 per month in advance, which will include one hour per month free flying time as a pilot. The member (pilot) will be "captain" of the ship at all times.

The resident associate member is entitled to the privileges of the clubhouse, the field, and club ships as a passenger. To become eligible for a full membership, the associate member must take dual instruction and pass a test for pilots and receive a pilot's license. The initiation fee for associate members will be $25, which will include a free initiation flight of one hour. The dues will be $2 per month in advance, which will include one-half hour per month free flying time as a passenger.

The nonresident member must be a qualified pilot residing outside of the city or the county. The initiation fee will be $50, which will include a free initiation flight of one hour. The dues will be $2.50 per month, which will include one-half hour per month free flying time as a pilot.

A nonresident associate member is entitled to the privileges of the clubhouse, the field, and the ship as a passenger, and must reside outside of the city and the county. He may become eligible for a nonresident membership by taking dual instructions and passing a test for pilots and receiving a pilot's license. The initiation fee will be $12.50, which will include a free initiation flight of one-half hour. The dues will be $1 a month in advance, which will include one-fourth hour per month free flying time as a passenger.

In all cases free flying time is accumulative. In other words, if the pilot or passenger does not obtain his free flying time in one month, he

(*Continued on page* 116)

WACO WINS AGAIN

—taking first prizes in the seasons major events

Winning Sweepstakes with best time from New York to Los Angeles.

Placing First in Transcontinental Air Derby—Whirlwind class—New York-Los Angeles.

Winning the International Race from Windsor, Canada, to Los Angeles.

First in National Air Tour by a margin of nearly 3,000 points.

Again demonstrating the same quality of performance which in the last seven years has been responsible for Waco's leading position in the industry.

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A Forced Landing

By Roger J. Adams

On the morning of the Fourth of July, 1919, a new Curtiss Hydroplane started to taxi across the Bay at Port Washington, Long Island. The plane was starting the initial flight of a pioneer air service up the Hudson River from New York to Albany. In the cockpit were Roger J. Adams, President of the Adams Aerial Transportation Company and Harold Hughes, a test pilot for the Curtiss Company. The cockpit was literally jammed full of packages from New York department stores, principally from Macy's, Franklin, Simons & Company, John Wanamaker & Company, Lord & Taylor, and B. Altman's, all for delivery on the first initial flight of the new Hudson River service to various points up the river. The accompanying story of the flight is told by Roger J. Adams, who is today assisting in the development of aviation on the Pacific Coast and is President of the Hollywood Aero Club.

IT was a very sultry morning and the whole Bay was like a piece of glass. Hardly a breath of air was stirring. The heavily loaded plane moved forward with a great rush and in a few seconds we were speeding along like a toboggan on its way down Mount Royal, but after more than a mile with everything she had, we were unable to get the ship off the water and after four unsuccessful attempts to take off, we returned to the hangar. Evidently we were loaded too heavily. We decided to unload part of the gasoline in order to lighten the plane. Using a piece of hose for a syphon, we soon filled several large pails with the excess gas, but as luck seemed to be against us that morning, someone accidently upset one of the pails, the contents of which was spilled all over our prize express packages, one a dress from Franklin, Simons & Company for delivery to Mrs. Alfred Smith, Executive Mansion, Albany, New York. However, we finally succeeded in taking off with our lighter load.

For more than a month before, from my office in the Times Building, we had made most careful plans for this flight. We were scheduled to stop at Newburgh, Poughkeepsie, Hudson and Albany. At each station a launch was to meet us and take off the freight. Approaching New York at about a thousand feet altitude, we made a graceful circle out into the Bay around the Statue of Liberty, came down and levelled off at about one hundred and fifty feet above the tops of the piers on the east side of the Hudson.

Monty Worthley of the New York Herald and Sam McFarland, publicity manager of the Waldorf and McAlpine hotels, were handling the publicity for my company at that time and they had been very busy for a week. Consequently as soon as we were recognized, we were greeted by the whistles of a dozen ships along the water front. By previous arrangement, I was to drop a package to a friend sailing for England at eleven o'clock that morning, on the Cunard liner, Orduna. The Orduna was just backing away from her pier and her whistle was wide open. As we came up to the ship I scored a bulls eye with a waterproof bag, containing letters and photographs. It landed on the top of the roof of the pier house and bounced on to the crowded deck of the Orduna and thus the first scheduled commercial air delivery up the Hudson River was accomplished amidst the cheers of several thousand onlookers.

We continued up the river and landed safely at Newburgh, our first stop, discharged our freight to the waiting launch, took off and sixteen minutes later, gracefully landed in front of the Yacht Club at Poughkeepsie and received a greeting from factory, locomotive and steam boat whistles. A launch came out promptly, took off the freight and delivered a message from the Commodore of the Yacht Club that a specially prepared luncheon awaited us in the club house. It was with deep regret that I declined the invitation as we were attempting to establish a schedule for a regular service and were then more than twenty minutes behind time with launches and reception committees awaiting us at Hudson and Albany. However, without leaving the ship we remained in front of the Yacht Club long enough to partake of a couple of bottles of refreshment and a box of graham crackers.

As we taxied under the Poughkeepsie Bridge, preliminary to our take off, we passed within a hundred feet of the steamer, Hendrick Hudson, on its day trip from Albany to New York. Hughes had the controls and pulled off a great piece of work in full view of hundred of passengers that lined the steamer's rails. We were merrily skipping over the water as we came opposite the steamer and with the speed of an express train, we piled into the first swell from her big left side paddle wheel. The impact nearly threw us out of the cockpit. Both of the wing pontoons cut the top of the wave and threw spray a dozen feet in the air but fortunately we were almost off the surface when we met it. In another instant we met the second swell which literally catapulted us into the air and like a drunken sailor we managed to keep upright and stay there. It was a beautiful display of nerve and skill on the part of Hughes.

In an effort to make up time we cut across country wherever we encountered any bends in the river, although we were flying very low in order that people along the river might read the sign on the bottom wing. Between Poughkeepsie and Hudson, we made quite a detour and when a considerable distance from the river, our motor coughed a couple of times and went stone dead. We instantly swung the plane toward the nearest point of water. We were quite low at the time and as we approached the river, we noticed a lagoon or back bay, on which a large brick yard was located. We could see that the water was quite shallow out from shore for quite a distance, as there were little piles of broken brick bats, standing out of the water. As we were losing altitude very fast and approaching a line of trees that stood between us and the main channel, we decided to take a chance on the shallow water. Luck was with us and we landed safely. Evidently we were out of gas. At least the three gallon gravity tank over head was empty. We investigated the main tank and found we still had a quantity of gas there. Undoubtedly the feed line was clogged. Suddenly I discovered the trouble. The empty paper box in which we had received our graham crackers from the Com-

(Continued on page 112)

let Hinton

World-Famous Trans-Atlantic Pilot

Train *You* for a Brilliant Future

The fact that you're looking through this magazine is proof that you sense the thrill of this great, big, new, booming, lustling, rushing industry—AVIATION. And the fact that you're looking at this page is *almost* proof that Minton's proposition will interest you—*tremendously.*

Hinton and H. R. H.

The photo shows Lieutenant Hinton describing the flight of the NC-4 of which he was pilot, to the Prince of Wales. As a flier, Hinton ranks among the country's few. And as an instructor he represents a combination impossible to beat—long experience, painstaking study and a natural ability to make things clear to others.

You know Hinton, of course—of his history-making hop across the Atlantic in the NC-4; of his pioneering flight from North to South America; of his amazing expedition to the wilds of the Upper Amazon. But possibly you *don't know* that in addition to being one of the outstanding fliers of the age, he is also widely recognized as one of Aviation's greatest teachers—as a highly accomplished trainer of men. During the War, Hinton became one of the Navy's crack flying instructors—and since Commercial Aviation has come into its own, he has forged to the front once again as the coach and co-worker of those who want to "get into the game."

Learn Where You Are:

No need to pass up the opportunity of a lifetime just because you haven't the time or money for several weeks' or months' at a school. No need to close your eyes to the great money making possibilities of this most fascinating of all industries, just because you're tied down to a job. For the important, essential, basic facts that form the foundation for real success in any branch of Aviation—whether you propose to climb the skies or keep both feet right on the ground—Hinton can give you quickly, thoroughly, and inexpensively—*right at home.*

10 to 40 Fine Jobs on the Ground to One in the Air

For every pilot there must be ten to forty trained men on the ground. Think of the high priced skilled workers needed—mechanics, electricians, welders, carpenters, pattern makers, draftsmen and a score of others—in the construction and servicing of a plane. Or consider the big money to be made by salesmen, instructors, demonstrators, private pilots, etc. In every corner of the land manufacturing, transport, air port, service and sales organizations are springing up. Thousands of them! And they all have valuable openings. But no matter what you do—what branch you take up—you must FIRST know the basic facts, the underlying principles, the "rules of the game." To **get started right,** in Aviation—to **grow** with Aviation—the practical, comprehensive confidence-giving knowledge that Hinton can give you is just what you need.

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Types of planes, their construction and uses; motors, ignition systems, carburetion; instruments; theory of flight, navigation and countless other essential facts. He'll teach you how to talk Aviation in the Aviator's language. How and where you can apply your own talents quickest and to best advantage. In clear, understandable language and with hundreds of pictures, charts and diagrams, he gives you the ment of experience covering years and years of study and many thousands of miles of flight. Furthermore, his remarkable course, admittedly one of the most complete ever produced—is backed by his own personal advice and assistance all the way through. He knows a plane inch by inch. He knows Aviation from its infancy. There isn't a better instructor anywhere today to help you get your start—or to back you in the future.

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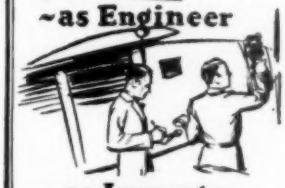

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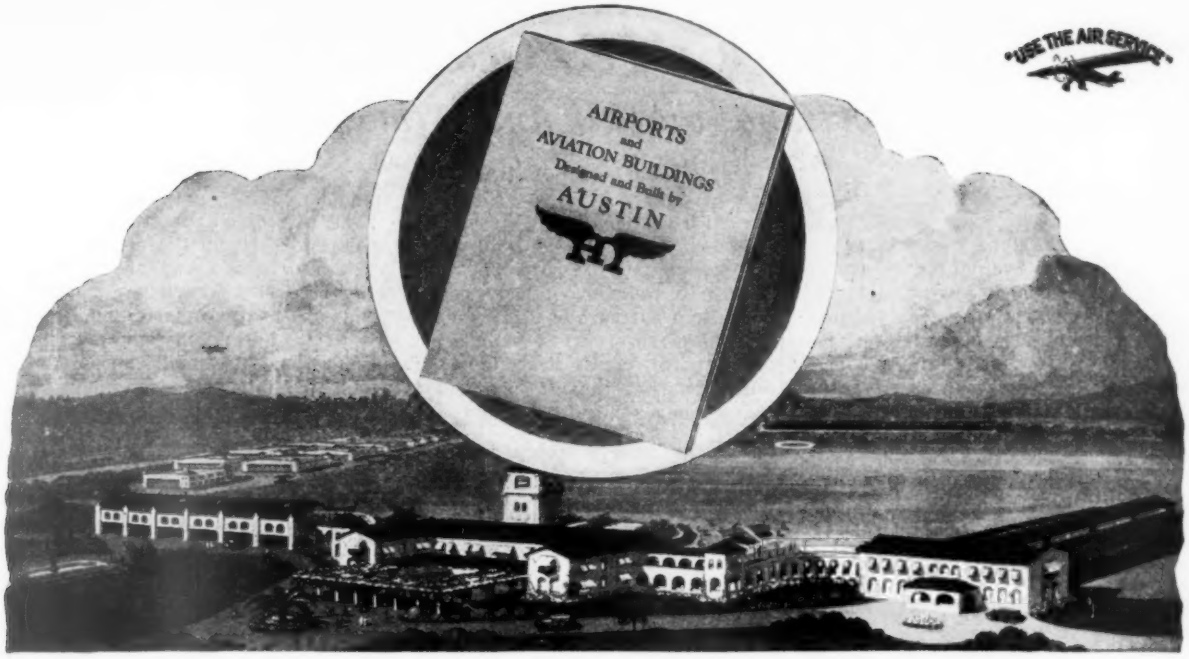

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Announcement

WILLIAM E. ARTHUR, formerly president of William E. Arthur & Co., Airport Engineers, and two principal members of his staff, have joined the Austin Company, of which Mr. Arthur will be Manager of the Airport Division.

The valuable experience which Mr. Arthur has had in designing several of the finest airports in the country, will further augment Austin's wide experience, extending over a period of more than ten years, in designing and building complete airports, hangars, aircraft factories and other aeronautical structures.

Mr. William E. Arthur will be located at Austin's national headquarters in Cleveland, but he and his staff will be available for any type of airport or aviation building project contemplated in any part of the country.

THE great forward movement ot the aviation industry finds Austin prepared with a nation-wide engineering and construction organization with specialized training and experience in this field.

In a score of cities from Coast to Coast, Austin has designed and built factories, hangars and other aviation structures. Just completed are the new Fairchild plant at Farmingdale, L. I. and the Spartan Aircraft factory at Tulsa. A repeat contract with Boeing at Seattle is now under way, and one with National Air Transport at Cleveland.

Whatever you may be contemplating—whether a complete airport, a hangar, a new factory or extension—Austin's specialized experience can be of great assistance to you in planning soundly and economically.

Under the Austin Method the complete project—design, construction and equipment—is handled by this one responsible organization with guarantees in advance covering total cost, speed of completion, and high quality of materials and workmanship.

For approximate costs and other valuable information, and a copy of the new booklet "Airports & Aviation Buildings," wire, phone the nearest Austin office or mail the Memo.

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Simple Aerodynamics

Properties of the Air and Atmosphere

By Alexander Klemin

NOTHING is really simpler than the aerodynamics which the pilot or even the designer of airplanes needs to know. But to study even simple aerodynamics with benefit, it is essential to have a grasp of a few underlying physical principles, which we propose to develop in this article and the next.

The air surrounding the earth and constituting the atmosphere extends to an immense height, perhaps 200 miles above the earth's surface. At great heights it is exceedingly rare and light, and probably completely devoid of living organisms. (Some of us may remember, however, Conan Doyle's weird story of tenuous beings existing many thousands of feet above the ground, who, with clutching tentacles, caused the doom of adventurous aviators.) Even at ground level, air is a very light gas. But the height of the air is so great that it exercises a heavy pressure at sea level. Luckily for us the pressure on our bodies is both external and internal, and its effects are not felt, otherwise we should collapse.

Standard Air

The high speed and landing speed of our airplanes are reported as having been found at ground level. But both the pressure and temperature of the air, and therefore its density, or weight per cubic foot, at ground level change from day to day, and changes in density affect the power of the engine and the performance of the plane. The greater the density the better the performance. The sales manager of an airplane factory with a knowledge of physics and aerodynamics might see to it that speed tests were made on a cold day when the barometer stood very high. His announcement of tests in POPULAR AVIATION would then show a decided superiority over the tests of other manufacturers, not so well versed in scientific matters.

Unfortunately the wily sales manager is defeated by the definition of "Standard Air" at sea level, which fixes once and for all the conditions to which a test should be referred. "Standard Air" represents roughly average conditions in the Temperate Zone such as the United States and is defined as: Air at 59° Fahrenheit and barometric pressure of 29.92 inches of mercury. This corresponds to a pressure of 2,117 pounds per square foot (or 14.7 pounds per square inch) which bears out our contention that the air exercises a tremendous pressure.

Standard Atmosphere

As we rise above the earth's surface, the temperature diminishes approximately at the rate of 1° Fahrenheit for every 300 feet, and the pressure drops also. So of course does the density.

The rate of climb at any altitude is dependent upon the density, just as is the high speed at sea level. Therefore climb tests are also dependent on atmospheric conditions. To avoid uncertainty as much as possible in the comparison of climb tests, a standard atmosphere, as well as standard air at sea level, has been defined. This standard atmosphere represents fairly well the average conditions found in the United States.

In Figure 1, we have plotted curves of temperature and pressures against altitude, and also the relative density or density at a given altitude as a percentage of the density at ground level.

The exact manner in which the horse-power of an engine falls off

(*Continued on page 70*)

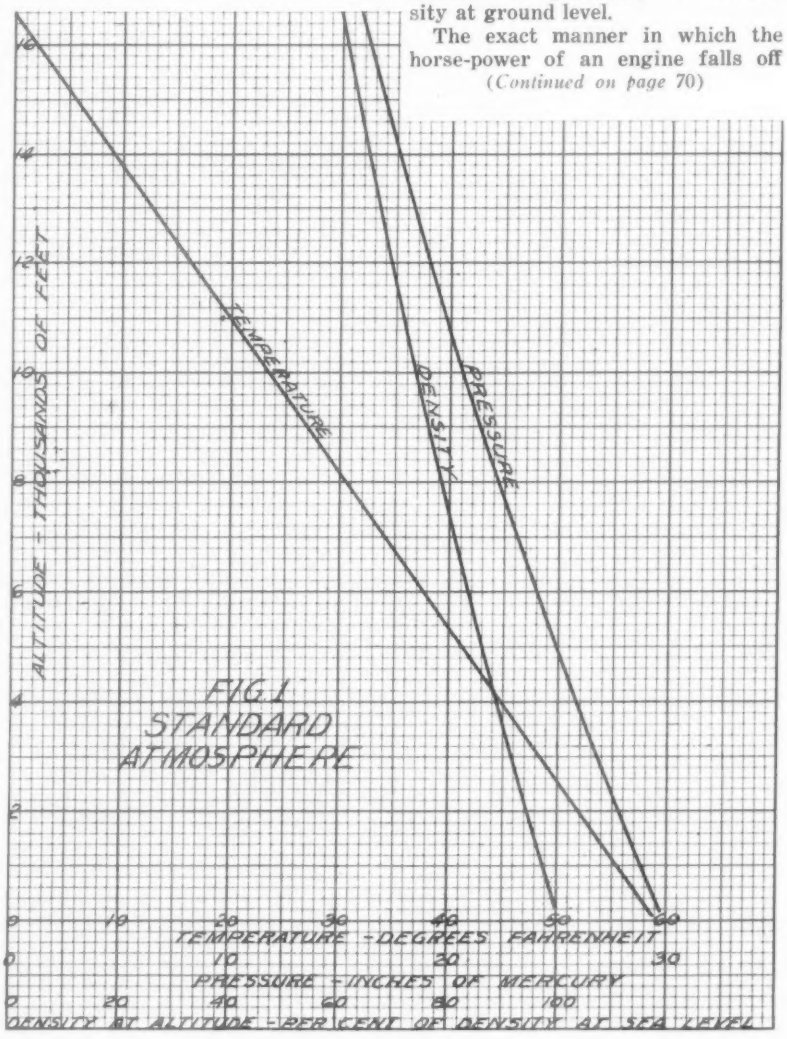
ALTITUDE - THOUSANDS OF FEET
TEMPERATURE
DENSITY
PRESSURE
TEMPERATURE - DEGREES FAHRENHEIT
PRESSURE - INCHES OF MERCURY
DENSITY AT ALTITUDE - PER CENT OF DENSITY AT SEA LEVEL

FIG. 1
STANDARD ATMOSPHERE

AN AIRPLANE FREE

ENROLL your name with us! Become a member of America's Greatest Air Society and help **"Make America Supreme in the Air!"**

Already The ASPA has organized over 400 civilian flying clubs throughout the United States. But we need more. Many more. And we need you! Helping to carry on this work in your community!

For The American Society for Promotion of Aviation will petition Congress to appropriate $40,000,000 to supply **gratis** airplanes to every organized aero club of fifty members or more.

In doing this, we are simply urging Congress to follow, without delay, in the footsteps of the Canadian Government, which supplies an airplane gratis to every civilan flying club. In fact, Canada goes further than this—for Canada pays each club $100 for every pilot turned out.

$40,000,000 Jokes

$40,000,000 will provide 10,000 modern airplanes for training purposes. This is less than the cost of a first class battleship. And as an editorial in one of America's greatest newspapers recently pointed out—battleships are fast becoming a joke. *What this country needs, and hasn't got, is the world's best fighting AIR Fleet.*

What the ASPA Is

The American Society for Promotion of Aviation was organized by 12 ex-service aviators at the Army & Navy Club, New York City, in 1925. It is a voluntary non-profit organization incorporated and maintained

To "Arouse and promote interest in aviation, as our strongest army of National Defense."

To make America air-minded—to cooperate with air-craft manufacturers in building up this newest industry—

To organze civilian flying clubs throughout this country and to help train pilots for national emergencies.

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Write for information as to how you may organize an aero club in your community

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Yes I am interested, and I want to add my name to the thousands already enrolled by you in your petition to Congress to provide funds to furnish airplanes gratis for civilian flying clubs, organized under the auspices of the ASPA or other accredited aviation organizations. Dept. PA

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with altitude is a complex question. The loss in power depends mainly on the density; the less the density the less the weight of air drawn in on the suction stroke. But the power loss depends on the pressure and temperature also. In conditions of standard atmosphere, the per cent of the sea-level power which is obtained at altitude may be fairly well represented by the curve of Figure 2. Loss of power at altitude will be discussed more fully later, but this curve is not out of place at this point.

Calculating Density From Pressure and Temperature

In performance tests of any kind, we have no way of directly determining density. In the physics or chemistry laboratory, it is comparatively easy to exhaust a vessel of known volume of its air, and to determine the density by weighing. This would be quite impossible on the flying field.

Two laws of physics fortunately give us a method of figuring density once the pressure is known from the altimeter or the barometer, and the temperature from the thermometer.

Boyle's Law is the first of these. Suppose we have a mass of gas in the cylinder of an engine, which is so slowly compressed by the piston that the temperature remains constant. If the piston moves so much that the volume is halved, the pressure will be doubled. Conversely if the volume is doubled, the pressure will be halved. In other words, if the temperature remains constant, the pressure and volume of a given weight of gas will vary inversely as one another.

The second law is Gay Lussac's. This states that when a gas is kept at constant pressure, the volume of a given mass varies proportionately to the absolute temperature. The absolute zero of temperature is the point at which all heat energy disappears (a condition only to be found in interstellar space) and is 459.4 degrees Fahrenheit below 0° Fahrenheit.

We will find it useful to modify these laws so as to bring in the density. At constant temperature, when the pressure increases, the volume diminishes. Hence density increases with increased pressure.

At constant pressure, when the temperature increases, the volume increases. Hence density diminishes with increased temperature.

Given these laws the density of air can be readily calculated if the pressure and temperature are known. These laws and ideas will also be found useful in the consideration of the engine power and are therefore doubly useful.

Our reader will find nothing so valuable in bringing home principles, as studying the simple problems that follow.

Shall We Get Good High Speed Today?

This is quite a practical question to ask. The few principles of physics dealt with, will enable us to answer this question readily. If the pressure is high, and the temperature is low, we shall certainly have high density and a good test.

Suppose, however, that the pressure is high, 30 inches on the barometer, and the temperature is high also, 80° Fahrenheit. The absolute temperature is $80 + 459.4 = 539.4°$ Standard air at 29.92 inches pressure, and 59° Fahrenheit or 518.4° Absolute has a density of .0764 pounds per cubic foot.

If the pressure rises to 30.00 inches, then by our modification of Boyle's Law, the density will increase in proportion to the pressure:

$$.0764 \times \frac{30.00}{29.92} = .0766$$

But since the temperature has risen, the density will decrease proportionately. Thus the density will be:

$$.0766 \times \frac{518.4}{539.4} = .0753$$

The combined effect of pressure rise and temperature rise will be therefore to lower the density, and therefore to decrease engine power and the high speed.

Loss of Engine Power at Altitude

One of the principal causes of the

(*Continued on page 97*)

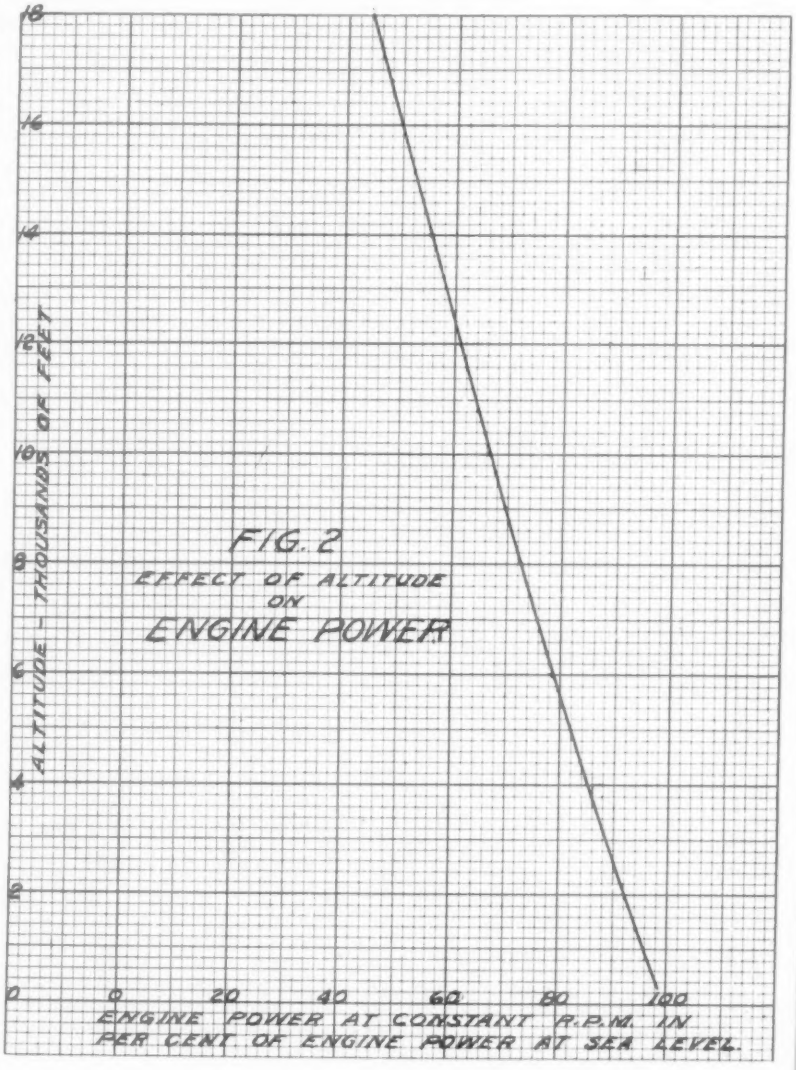
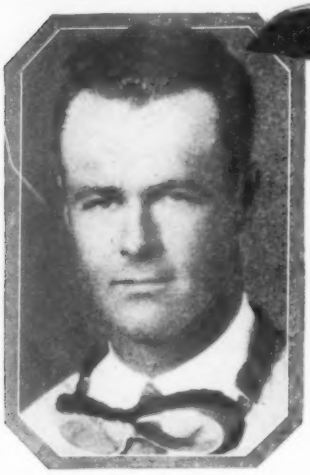


FIG. 2
EFFECT OF ALTITUDE ON ENGINE POWER



ROWLAND Wins with a CESSNA

YOUR skill and daring, Earl Rowland, have placed your name in the front rank of aviation's "Hall of Fame." We are proud of you, and proud, too, of the fact that you chose a Cessna plane to help you win.

You have proven to the world what we have long contended —that the Cessna Cantilever Cabin Monoplane will outfly any other cabin plane ever built—horse-power for horse-power.

Not once, but twice have you proven this fact—first, in winning the Class A Cross-Country Derby, and, second, in winning the Closed Course Event No. 2 at Los Angeles. You are doubly entitled to our congratulations, and we are indeed happy to have had our share in your triumphs.

WHEREVER the air-minded gather, one name is heard on every hand — CESSNA! Already orders are pouring into the factory for duplicates of the plane in which Rowland flew to success.

This product of the old Master, Clyde V. Cessna, bids fair to be in the greatest demand of any airplane ever manufactured. The plane that Rowland flew was a strictly stock model — no clipped or racing wings, or other special features—but the same plane that we have been delivering everywhere in the country for many months past.

Don't forget, either, that in Class B, the Cessna, piloted by Schultz, was the *first strictly commercial plane of any type* to cross the line at Mines Field — again proving Cessna superiority.

There's a golden harvest awaiting the Cessna dealer. Will you be one of them? Wire or phone us quick, and we'll tell you if your territory is still open.

The Cessna Aircraft Co.

Wichita, Kansas

Financial Survey of Aviation

By R. D. Small

General Manager, Aviation Financing and Trading

INTEREST of investors in aeronautical securities has increased to a surprising extent in the following key cities: Chicago, New York, Detroit, St. Louis, Los Angeles, Louisville, Minneapolis, Buffalo, Seattle and San Francisco.

Market appreciation in many stocks during the last month has been quite dramatic. At today's (Oct. 8th) figure Warner Aircraft Engine has advanced 35 points, National Air Transport 105 points, Curtiss Flying Service from 12½ to 18⅞; Aviation Corporation of America from 18 to 30, National Aviation Corporation from 30 to 39, Travel Air about 30 points, Bellanca 55, Sikorsky Aviation Corporation from 12½, original offering, to 19¼.

Fairchild Aviation has just been reorganized on the following basis: Former 150,000 shares of "A" stock has been increased to 300,000, with total authorized of 500,000. The former 30,000 class "D" stock has been increased to 60,000, 85,000 shares of the new "A" to be handled by the bankers. The present market of new "A" 28½ to 29½.

A split-up of 25 to 1 in Western Express is currently reported as an expectation of several of the stockholders.

Stinson Aircraft for each one unit of the old stock has issued five shares of *new* common. It is now quoted (Oct. 8th), 24 to 25¾.

Swallow Airplane Company is reported to be engaged with their bankers in what is claimed will be a stock split-up of 10 to 1, although we have no definite corroboration of the completion of the new plans at this writing.

American Eagle has completed its refinancing plan. New common stock is to be offered at $7.50 a share.

Sikorsky Aviation Corporation was recently offered by a strong underwriting group consisting of G. M. P. Murphy, National Aviation Company, both of New York, and James C. Wilson of Louisville. The board of directors include, among others, the following: J. Cheever Cowden, vice-president of Blair & Co.; Charles S. Jones, president of Curtiss Flying Service; John J. Mitchell, Jr., vice-president of the Illinois Merchants Bank, Chicago; Joseph E. Otis, Jr., Chicago, director of the Central Trust Co.; Earle H. Reynolds, president of the Peoples Trust & Savings Bank, Chicago; James C. Wilson of the J. C. Wilson Company, Louisville, also president of National Aviation Corporation; James Bruce, vice-president of National Park Bank, New York; O. A. Glazebrook, Jr., of G. M. P. Murphy & Co., New York; R. C. Stanley, president of the International Nickel Co., etc.

This company has been generally included in the group of the acknowledged leading three or four plane manufacturers in the country. Work carried on during the past five years at a cost of over a mililon dollars has resulted in the new Sikorsky Amphibian S-38. This craft can take off from either land or water even though fully loaded. It is a large dual motored, all metal plane, capable of carrying up to ten passengers, with mail, baggage and express. It sells completely equipped for about $55,000. Sales have been made to a number of transport companies, such as Western Air Express, Pan American Airways, to the Government and a few private individuals, such as Mr. Walgreen, prominently identified as the owner of the Walgreen chain of drug stores; Cornelius Vanderbilt Whitney and others. The Curtiss Flying Service has taken over the United States sales agency for the products of this corporation, and the Curtiss Export Corporation for all foreign countries. It is expected that two planes a week will be produced after the first of the year.

Financial Structure. Five hundred thousand shares authorized. Presently to be outstanding, 200,000 shares, of which 100,000 shares is retained by the management. Stock originally offered at 12½ has advanced today (Oct. 8th) to 19¼, with a strong demand at this writing.

Curtiss Flying Service, Inc., has established three of its twenty-five new flying fields in its program of completing a nationwide transport and taxi service—Portland, Me.; Bridgeport, Conn.; and Miami, Fla. Mr. Chas. S. Jones, president of the company, was kind enough to give to the writer the following additional cities where the service will be installed as rapidly as possible: Chicago, Philadelphia, St. Louis, St. Paul, Detroit, Buffalo, Indianapolis, Columbus, Denver, Seattle, Portland, San Francisco, Los Angeles and a number of Texas cities, and others to be installed later. He also stated that an extensive service would be provided for Florida tourists this winter.

Some highly satisfactory "crop dusting" contracts in the southern states, together with the sales agency of the Sikorsky plane and certain other values representing work formerly completed but not until recently reflected in the market price of Curtiss Flying Service, accounts for recent steady advances from 15½ to 19⅛.

Those close to the original group of banking interests of the organization claim that a market level of between 23 and 25 will be seen in the near future.

In this connection it is of interest to note that Col. Lindbergh in his address at the National Aeronautical Safety Conference, held in New York October 4th and 5th, stressed as one of the greatest needs of the moment: Higher standard of flying schools, with a greater sense of responsibility and better instruction methods; also a universal standard, federal rather than state, for all pilots carrying passengers. He said in part: "Schools in the past have not been particularly well organized. In many instances the practice has been to advertise the course for the low cost rather than the high quality." And again: "Our flying schools should be rated by their standing and patronized on account of their excellence as are our universities and colleges. Uniform regulations should be obtained by the individual states adopting Federal flying regulations of the department of Congress." And again: "It certainly is not advisable to have a number of student pilots operating from the same field with passenger transports." The highest possible course of instruction, even including the installation of three universities, is a part of the Curtiss Flying Service program. We have been advised by a number of students that they

(Continued on page 102)

DO WE OR DON'T WE—SEE FOR YOURSELF

SOME OF OUR GRADUATES—THEY CAN FLY

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WHAT YOU GET OUT OF IT . . . DEPENDS UPON YOU!

But—we do promise to teach you how to fly, and to adapt yourself to the other requirements necessary to success in AVIATION other than Aeronautical knowledge. Our new Ground School Course is the finest that can be found in any school of Aeronautics excepting the Army Schools. We are sparing nothing which will benefit our graduates. Our Mechanical Shops are by far the most complete.

Our Training Planes Are Equipped with Safety "Break-Away" Controls
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Airplane and Motor Mechanics $100. Private Pilot $350. Limited Commercial Pilot $800.
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"School of Aeronautics"

COMPLETE AIRPLANE SALES AND SERVICE

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Photo—Gary, Indiana, AIRPORT. Owned and Operated by Atkinson Aviation Co.

Financing Flying Clubs

By G. M. Pynchon, Jr.

THE needs of my business have, to my own great misfortune, located my desk in a rather conspicuous spot in the office. Unless the doorman is at his appointed post, which is rarely, insurance salesmen, charity workers, beggars, job-seekers, subscription sellers, trade association representatives, promoters, realtors and other persuasive ladies and gentlemen who individually entertain the ardent belief that they have something for me that will change the course of my life are free to introduce themselves, sit at my elbow and start talking.

Among the maniacs whom the strong arms have recently extracted from the proximity of my desk, have been some promoters of flying clubs The fact that I am known to be an aviation enthusiast, and that my desk is surrounded by pictures of aeroplanes has probably caused these business men to approach me in abnormally large numbers.

One flying club man I have listened to and allied myself with—the rest talked a common language, which went somewhat as follows:

"We will buy two planes at $3,000 each, pay instructors $5 an hour, allow $60 a month hangar rental, $500 a year for overhauls and repairs. Fifty students will need to pay down $100 each, and half of their yearly dues of $100 in advance, and they get their instruction for $17.50 an hour, and solo time at $12.50. You can see this is a perfectly sound proposition financially, so I not only expect you to join, but I think you'll want to underwrite it unless you're crazy."

After the talker has been removed I take time out to ponder why such creatures exist. Some of my friends tell me that this type of promoter has reaped tidy little sums by organizing flying clubs on the gold brick basis. The history of clubs so formed is almost invariably the same. A plane wears out or is cracked up, and there is no money in the kitty to put things right again. The members of the club then try to locate the promoter to raise some more money for them, but he by this time is operating in some other part of the country: the disappointed members of the club pay their assessments and wonder what there is to this flying club business, after all.

The activity of quack promoters is the more astonishing in the face of a legitimate movement which is now in progress. A group of men and women prominent in aviation activities, including Charles Lawrence, Sherman Fairchild, H. P. Davison, C. V. Whitney, Miss Estelle Manville, Miss Ruth Nichols and others, are associated in an organization known as the Aviation Country Clubs. This organization was formed to establish a string of elaborate flying clubs throughout the country. Membership in one club includes privileges at all the other clubs; in other words, it will eventually be possible for a member of this organization to tour the country in his plane, or in his club's plane, and land at club fields at all points.

This rather ambitious idea may at first seem impractical but closer scrutiny of their plans will uncover many object lessons for those individuals who are considering the establishment of flying clubs. In spite of proposed purchases of expensive real estate, the erection of club houses, hangars, etc., it is estimated that a pilot who normally does 150 hours of flying a year in hired ships, will save the amount of his initiation fee and first year's dues in about six months, if he is a member of one of the Aviation Country Clubs. The secret of these results lies in properly estimating and foreseeing all costs and providing them efficiently. For example, before making any attempt to interview prospective members, the organization management of Aviation Country Clubs went to the foremost air transport engineer of the country, Mr. Archibald Black, of Black and Bigelow, who worked out a theoretical prospectus.

Many clubs fail through lack of proper financing and an unwillingness to face the fact that a sound basis for the operation of a club cannot be obtained unless definite arrangements are made at the start to take care of the financial obligations that will be incurred.

When a site is chosen for a club, (under this engineer's guidance) a prospectus, or "cost forecast" is made up for the individual club. I propose to discuss a typical prospectus; though one I have chosen was made up for one of the Aviation Country Clubs now in process of organization. This particular club is to be rather complete in that it will own its own club house and will have exclusive use of a splendid field, but no real estate is to be owned. Expenditures are classified as original investment, constant costs (or "overhead") and variable costs. First, let us see how the estimate for the original investment is arrived at.

Mr. Black has much to say concerning the type of aeroplanes to be used. Aeroplanes for training purposes must not only be simple to fly, but they should have a high factor of safety, because all flying courses should include stunt instruction. Furthermore, the cheapest aeroplane to buy is not necessarily the cheapest to operate. After allowing for delivery charges it is estimated that two machines, powered with modern motors, will comprise an initial investment of $11,000. If OX motors were used this initial investment would amount to $7,200, but assuming an active existence for the club, more expensive motors would pay for themselves by the end of a year.

For a roadway leading to the club house, the landscaping of surroundings, a parking area and a small amount of fencing, about $1,500 is allowed.

For the club house, which is to be a frame building of simple but reasonably artistic type, with the following rooms: lounge, locker room with one hundred very small lockers, main dining room seating 24 persons, a kitchen and pantry, a card room with two tables, a shower bath, a men's toilet, a ladies' toilet, a servants' toilet, a small bed room for the caretaker and a small room for office use, about $30,000 will be needed.

Water system connections with the club house, extension of telephone, and electric power lines will come to approximately $200. For miscellaneous small items $100 is allowed. Architects fees, engineering costs, supervision of construction and simi-

AVIATION has a Place for YOU

Get the right training and win Your Success

This student obtained a good position with an airplane company after graduating from Marshall Flying School. Superior training helps the student into such positions.

Choose the position you want—pilot, mechanic, designer, aircraft business man, field superintendent, airport manager, aircraft manufacturer—countless big positions are open for the trained man in every line of aviation. Take the training that will equip you for any one of those positions—get the newest features of aeronautical training at the College of the Air. . . . The "jack of all trades" has no place in aviation—masters are wanted. You need a specialized training. Marshall Flying School has new courses, new equipment and new methods of instruction to give you the help you need; all courses are offered now.

It's Easy to Start With Straight Flying Course at $75. For the low cost of $75 you can enter aviation and take all the fundamentals. This course, teaching you regular flying, will be a stepping stone for you—a means of entrance in the greatest of careers.

This Straight Flying Course is but one of the many new courses which the College of the Air has introduced after four years of experience is giving aeronautical training to young men.

Mail the coupon below and get the free catalog which explains and describes the new courses and tells you how you can find your way into this promising industry.

Straight Flying Course—Regular flying instruction including the fundamentals and requisites of ordinary flying. Price (without ground course) $75.00

Primary Flying Course—Work in Straight Flying Course and advances students to crosswind landings and take-offs and difficulties encountered in flying in all sorts of conditions. Price, including Mechanic's and Engineer's Ground Course $150.00

Intermediate Flying Course—Instruction given in both Straight Flying and Primary Flying Courses and advances student through full 10 hours of work in the air. Student can be soloed if ability is shown. Price, including Mechanic's and Engineer's Ground Course $200.00

Complete Aviation Course—All principles of flying and every needed requisite to make you a successful flyer. Forced landings, cross country and all-weather flying. Solo flying guaranteed. No bond required. Price, including Mechanic's and Engineer's Ground Course $245.00

Private Pilot's License Course—Flying time and training for a private pilot's license. Training qualifies you for eligibility for license. Ten hours of solo flight. Arrange your examination at field. No bond required. Price, after solo $150.00

Limited Commercial Course—Special advance course. Qualifies you under the Department of Commerce for the Government Limited Commercial Pilot's License. Get the Primary Flying Course and 50-Hour Advance Course. Price, including Mechanic's and Engineer's Ground Course $700.00

Mechanic's and Engineer's Ground Course—Especially to prepare for mechanics, ground and factory work. Also beneficial to contemplated flyers. Course includes metal airplane construction, repair and maintenance; motor assembly and overhaul; steel fuselage construction and repair; aerial mapping, meteorology, navigation, instrument reading, and theory of flight. Undoubtedly the finest ground course in the country. Plenty of equipment. 300 hours training. Price $75.00

This course is given free with all our flying courses with exception of the Straight Flying Course.

After taking the training at Marshall Flying School, this graduate is thoroughly trained for this important manufacturing work in an airplane plant.

One class of the Marshall fall term students who are taking aviation training under the new methods.

GET THIS BOOK FREE!

Mail the coupon and receive this catalog. It shows you the equipment, buildings and the large number of planes used at this school — explains about the new courses —tells how you can make your start and win your way.

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lar incidentals will amount to approximately $3,180.

A wind cone and mast, a barometer, a thermometer and other small items come to $125. $75 is allowed for some incidentals, such as marking obstructions around the club house. Hangar, shop and garage equipment are to be provided chiefly by the operator of the field. To allow for small items for the use of club members or mechanics $100 is allowed. For club house furnishings, an item which is subject to great variation, at least $5,000 should be allowed and preferably $6,000. The club will need a small passenger car to be available for the personnel on miscellaneous duties, and this will cost $116. Minor supplies, such as flares for emergency night landing, are estimated at $250. In addition to the two aeroplanes, two parachutes should be provided at a cost of $700, and some spare parts for aeroplanes and a few engine parts should total $1,500. Incidental costs can safely be estimated at 5%, or $665.

In orther words, investment in the building and incidentals total $34,980. Ground equipment, including club house furnishing, total $7,786. Flying equipment totals $13,986. Organization costs, including incorporation expenses and incidental expenses total $850. The total initial investment for this club, therefore, amounts to $57,581.

In order to provide an adequate working capital it is suggested that there be provided a fund equal to at least three month's fixed charges, exclusive of dining room, etc., or about $7,812.

Fixed operating costs are estimated as follows:

The rent of field facilities, use of ground for club house, etc.	$5,000.00
Rent of hangar space for two moderate sized aeroplanes at $30 per month.	720.00
Depreciation of club house building, 5 per cent, or	1,500.00
Depreciation of club house furnishings, 3 per cent, or	999.00
Depreciation of aeroplanes and spare parts exclusive of engines, 20 per cent, or	2,300.00
Telephone facilities	75.00
Office supplies and incidentals on flying operations.	100.00
Rent of gasoline tank and pump	5.00
Water and light	250.00
Heating of club house	600.00
Fire insurance	183.33
Fire insurance including liability, property damage, crash (less deductible), fire, theft, tornado, etc.	2,775.00
Annual overhaul of two aeroplanes	3,000.00
Allowance for test flying	6,000.00
Salary of general manager and flying instructor	6,000.00
Salary of first class mechanic at $65 a week	3,380.00
Salary of caretaker with room and board	1,300.00
Billing, auditing, etc.	1,200.00
Locker expenses	500.00
Contingencies	2,840.00
	$33,027.33

Variable operating costs are estimated as follows, based on a modern plane and engine:

Gasoline, oil, greases, etc.	$3.00
Engine depreciation on basis of 1,500 hours life with engine costing about $2,750 and with no allowance for salvage	1.83
Allowance for minor crashes and for deductable amount of insurance policy in cases of serious crashes, about two engine overhauls, one for every 250 hours at $200 each	.80
Contingencies and miscellaneous at 10 per cent	.76
Total hourly flying costs, to be added to fixed costs, without allowance for hiring of pilot, therefore amount to	8.39

The above figures cover organization and operation of a rather elaborate flying club which, however, is so organized as to make unnecessary any investment in a flying field or in any real estate whatsoever.

Due allowance is made for those items which the ordinary promotor invariably overlooks, namely, contingency for crashes, depreciation and vague, but extremely expensive, incidentals. A club of this kind will naturally have a limited membership.

In this particular case, initiation fees average $675 per person. However, from this prospectus certain items can be picked out which will fix the approximate cost of the cheapest type of club, namely that whose only property is a contract with the instructor and a certain number of aeroplanes and spare parts. Let us see what these items are and what they total, and then compare the result with the figures usually presented by the gold-brick promoter. It must be remembered that figures are different for each club and vary according to its location, purpose, and activity, therefore the figures I mention are applicable only to a certain club, and are presented only as examples of the type of analytical work necessary before a flying club can be correctly organized.

Here is a typical prospectus by Black and Bigelow covering a flying club located at a public field. Fixed investment is distributed as follows:

For two, three-place dual control machines complete with engine approximate cost delivered in New York is $11,200. Spare parts absorb $750. Two parachutes to be used for stunt flying instruction cost $700. A limited amount of office equipment will be necessary, and this amounts to $250. Small tools and miscellaneous equipment count for another $250, whereas for incidentals and contingencies a reserve of $500 is allowed. Total fixed investment for this type of club is therefore $13,650. This may vary with different clubs. It may safely be put at between $12,000 and $15,000.

Proprietary membership in a club with this equipment would therefore cost approximately $275, if there were fifty members. Membership can be increased, of course, to spread the cost more thinly. The results of this would naturally be that each member would get considerably less flying. Annual costs are somewhat as follows:

Rent of hangar space for two aeroplanes, with the use of field and desk room in one of the field buildings, would be approximately $900 per year.

Depreciation of aeroplanes, parachutes and parts (exclusive of engine depreciation which is allowed for under "variable costs") at 20 per cent is $1,142.

Flying insurance on aeroplanes, including fire, theft, tornado, crash, public liability and property damage, $2,800. This item is most important and is one which is usually overlooked by the promotor of flying clubs. If no insurance is carried the student must be liable for the plane, and this means that each member must have a capital of at least $10,000, which is obviously impractical.

Fire insurance on spare parts, tools, office equipment, parachutes, etc., is $9.75 per year. Office supplies and incidentals will come to about $250 a year. Annual overhaul of two aeroplanes can safely be estimated at $2,000. Two hundred and fifty dollars should be allowed for test flying.

Salary or guarantee of pilot instructor is $6,000. One first class mechanic at $65 a week will cost the club $3,380 a year. If no mechanic

(*Continued on page* 112)

"Young Men Will Do Well to Consider the Calling of Airplane Pilot"

—Colonel Paul Henderson

The World's Greatest Opportunity Lies in the World's Fastest Growing Industry!

COLONEL HENDERSON, who is known as father of the air mail, and who is now general manager of the National Air Transport, speaks with authority. He has watched commercial aviation grow from a single experimental air mail line, which he was instrumental in starting, to a vast transport system which flies hundreds of planes over more than 25,000 miles daily to carry United States Mail, alone! He has seen aircraft factories spring into being to build 5000 planes this year for airlines, business and individual use. He predicts that

"10,000—possibly 15,000 planes will be built in America in 1929"

and asks

"Where will the pilots come from to fly these ships?"

Colonel Henderson is right. There is a tremendous demand, not only for pilots, but also for mechanics, factory construction men, airport operators, airplane salesmen, and a dozen other types of aviation specialists. For every ship in the air, there must be twenty men working on the ground to build it, sell it and service it. There is no field offering greater money than aviation! There is no field in which able-bodied, red-blooded men with intelligence and foresight can go to the top faster! There is no field offering more thrills, adventure and glory!

The Porterfield Flying School has a vital message for you about flight training in new licensed planes under veteran transport pilots; and about ground school instruction in one of America's largest and busiest aircraft factories, with men who are leaders in the industry serving as your teachers . . . Learn how this school prepares you, through the finest system of instruction and with the most complete and modern equipment in the middle west, to take your place and make good in aviation! *Write or wire at ONCE—right NOW—for "A FLYING MESSAGE"!*

THE PORTERFIELD FLYING SCHOOL, Inc.

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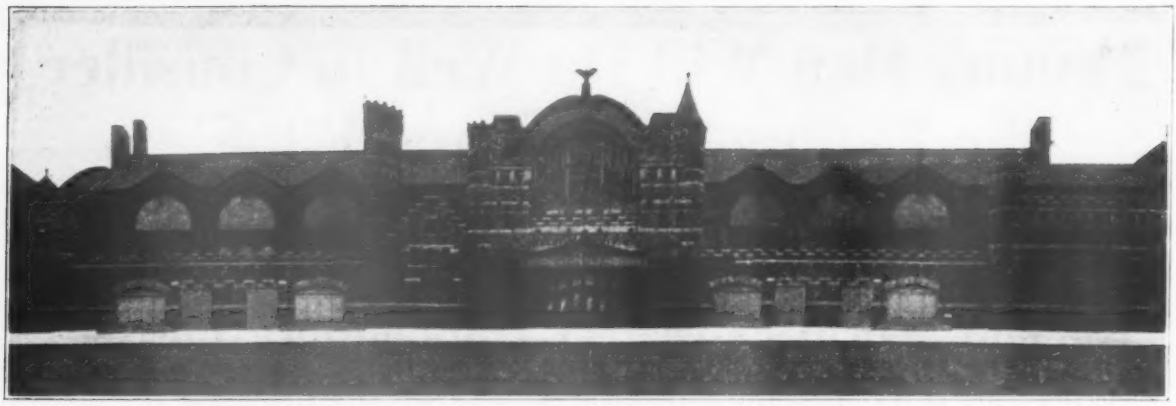

The International Aeronautical Exposition

THE First International Aeronautical Exposition, directed by the Aeronautical Chamber of Commerce, will be held in Chicago, December 1 to 9 inclusive. It will be the first all-commercial aircraft show and will exceed in size even the post war Exhibit held in New York in 1919 which was wholly military.

The Aeronautical Chamber has leased the Coliseum and the First Regiment Armory, Chicago's largest exhibition halls. A canopied walk affords entrance from one building to the other, making the exposition practically under one roof. Though containing more than 100,000 square feet, requests of manufacturers of aircraft and accessories have reached the Chamber in such number that it is questionable if these two buildings will be sufficient in size to house the displays of all those who have made application.

Chicago's official help has been assured by the active part the Mayor's Aero Commission and the Aviation Committee of the Association of Commerce are taking in the plans. These organizations feel that the exposition will not only help to keep Chicago the center of the nation's Air Transport activity but will also establish the city as the logical meeting place of manufacturer and buyer.

The available space has been allotted so that airplanes will be shown exclusively in the Main, North and South Halls of the Coliseum and in the Armory. Accessory exhibits will be placed in the Coliseum Grand Ball Room and in the balcony.

The Chicago Municipal Airport will be available at all hours to those manufacturers wishing to keep planes in readiness for actual demonstrations. Those who will fly ships which will be put on exhibition will find cartage facilities ready at a minimum cost.

In addition to the invitation extended by the Chamber to foreign exhibitors, the international flavor of the Chicago show will manifest itself in the presence of the more than 200 delegates from possibly forty-nine different nations who will be in this country to attend the International Conference on Civil Aeronautics which President Coolidge has called for Washington, December 12, 13 and 14.

The Chamber planned its exposition so that the delegates might come direct from New York and get a close-up view of the extent of commercial flying in this country before starting their conference deliberations. The site was chosen as easiest of access for manufacturers and because the Windy City is the largest concentration point for airport and air mail lines.

The foreign delegates, on arrival in Chicago, will be honored guests of the city. Their entertainment, including an international banquet, will be in charge of a committee appointed by Colonel Paul Henderson, representing jointly the Chamber of which he is vice-president for the Great Lakes Division, the Executive Committee of the Air Conference and the Aero Commission of which he is chairman. This committee includes: Major Reed G. Landis, secretary of the Aero Commission; Elmer Stevens, head of George A. Stevens & Brother; George B. Foster, Commonwealth Edison Company and vice-president of the Association of Commerce; Earle B. Reynolds, president Peoples Trust and Savings Bank, and George Getz, capitalist.

The American Society of Mechanical Engineers, Aeronautics Division, will be in session at the time and its meetings will be open to the delegates. As many of them are engineers it will give a splendid opportunity for an exchange of old and new world engineering knowledge as it pertains to aviation.

Of equal importance is the interest which has been aroused in the plan to set aside one night to honor the old time pilots, those men who flew planes of pre-war days and those who maneuvered the combat, bombing and other ships during war time. Those in charge of this affair want to hear from all the "old timers" who will or can be in Chicago during the exposition. Those interested should get in touch with Reed Landis at 26 East Huron Street, Chicago.

THE STEVENS

THE WORLD'S GREATEST HOTEL

Michigan Boulevard, 7th to 8th Streets **CHICAGO** *Ernest J. Stevens, Vice President and Manager*

3000 OUTSIDE ROOMS 3000 PRIVATE BATHS

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On Michigan Boulevard, overlooking Grant Park and Lake Michigan
More convenient to railroad stations than any other hotel
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Largest and finest ballroom in the world
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Twelve hundred seat theatre
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Seven ballrooms accommodating from two hundred to five hundred
Many small meeting rooms and private dining rooms
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Agency for all theater tickets in lobby
Ballrooms equipped with most perfect public address systems
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Private telephone exchange capable of serving a city of 15,000 people
Largest isolated private power plant in the world

CHICAGO, the World's greatest Convention City, and the STEVENS HOTEL, the World's largest and greatest hotel, will extend a cordial welcome to those attending the International Aeronautical Exposition to be held at the Chicago Coliseum under the auspices of the Aeronautical Chamber of Commerce of America, December 1st to 9th. During that week The Stevens will be headquarters for—

The Aeronautical Chamber of Commerce of America
The Society of Automotive Engineers
The American Petroleum Institute

ROOM RATES

Number of Rooms	Single Rate	Double Rate
201	$ 3.00	$ 4.50
822	3.50	5.00
976	4.00	6.00
201	5.00	7.00
207	6.00	6.00
358	7.00	7.00
135	8.00	8.00
57	9.00	9.00
45	10.00	10.00

FIXED-PRICE MEALS

JAPANESE LUNCH ROOM
Breakfast 45c Luncheon 65c Dinner $1.00

COLCHESTER GRILL
Breakfast 60c and 75c Dinner $1.50 — Luncheon 85c Sunday Dinner $2.00

OAK ROOM
Breakfast 60c and 75c Dinner $1.50 — Luncheon 85c Sunday Dinner $2.00

MAIN DINING ROOM
Luncheon $1.25 — Dinner $3.00 per person

A la carte service at attractive prices is available in all restaurants at all meals.

The Cradle of American Aviation

By H. H. Slawson

I STOOD one morning not long ago on the crest of a lofty sand dune which rises above the blue waters of Lake Michigan near the tip of its southern shore at Miller, Indiana. In the frosty autumn air a sea gull rose from the waves and drifted lazily in, to circle, dip and soar around me.

Suddenly on the breeze came the drone of an airplane motor and shortly the speck against the sky grew bigger until above me I could distinguish the symbols painted on it. The ship was winging from Detroit to Chicago along the newest airway leading into that great commercial center. Probably the pilot saw me not, but if he did he doubtless was unaware that where I stood was a spot so intimately linked with his own occupation; that here in the soft Hoosier sands at Miller was the cradle of the great machine he was guiding.

Possibly he knew nothing of the man who some thirty-two years ago had stood on the crest of this same sand-bank and like myself, had watched the soaring sea gulls, praying pathetically, as I prefer to fancy, that somehow the secret of their flight might be revealed to him.

Chanute Hill that sand dune is named by such old settlers of Miller who still recall the summer of 1896 when Octave Chanute, the "father of American aviation," came here to learn how birds fly.

Today thousands of people know the place as an ideal summer bathing beach. But ignorant they are for the most part of what transpired in the hollow of these hills scarcely a generation ago. They know not that here, as in a cradle, with tender but determined nursing the embryo of the age's greatest mechanical achievement was given form and being; that here the aeronautical infant took definite shape and the breath of life was imparted to it; that from this nest the tiny fledgling was launched forth on timid but exultant pinions which grew stronger at every stroke until today—but today is quite another story.

Certainly as I stood there in the autumn sunshine the airplane zooming overhead seemed the consummation of Octave Chanute's dream about the sea gulls and the answer to his prayer. To understand the story fully it might be well to go back a bit into that year of 1896.

It was a year rich in aviation history with many milestones erected along the trail which men were blazing as they sought the realization of the age-long dream of "flying like birds."

On May 6, 1896, Samuel P. Langley, secretary of the Smithsonian Institution, after years of delay and disappointment, sent his model aerodrome whizzing above the Potomac near Washington for a distance of over half a mile in a minute and a half. The engine ran out of steam and the device fell into the water and then Langley began to "hear from the country."

Octave Chanute

Editors everywhere denounced as sheer folly the fatuous fancy that men would ever learn the trick of flying and they suggested a halt in the further expenditure of public funds in this futile manner.

In Europe Otto Lilienthal had modelled himself a pair of gigantic wings resembling a bat's pinions and with "strictly bird-like" procedure, as he expressed it, was hopping from the top of his cinder hill at Steglitz, six miles from Berlin, to learn what he could learn. On August 12 his spine was broken in a flight which he had intended to be his last with that type of apparatus. When he died relatives immediately reduced to ashes the implement of his destruction.

August 20 was another red letter day in that auspicious year. Scarcely had the cables borne the message of Lilienthal's sacrifice than again they flashed around the world another aviation message—"flying machine a success."

Up at Old Orchard, Me., at the annual fair of the New England Agricultural Society, Charles M. Lamson, a Portland, Me., jeweler and manufacturer of luggage bags for bicycles, had sailed his kite-like contraption, the "Lamson airship." Before a gaping crowd it raised a 150-pound dummy figure of a man 600 feet above the earth. Then the cord broke, but the figure got down undamaged. It was only a flash in the pan but permit a quotation from the Portland Daily Press of August 21, 1896:

"It quivered a moment and then straight and steadily the big aerial monster rose skyward amid the shouts of the multitude. Seated on the car of the ship was a dummy weighing 150 pounds and the ship carried it without wavering or any perceptible quiver. On the ground the watchers shuddered at what might be the fate of a man aboard."

Says the Press further: "Mr. Charles M. Lamson performed yesterday what is probably the most remarkable achievement of the age thus far in regard to practically demonstrating that a large airship or kite capable of carrying a man can be successfully and steadily floated."

Lamson, the home town paper proclaimed, had "(1) flown the largest kite ever floated (2) carrying the heaviest weight (3) to the greatest altitude on record."

It was, the newspaper asserted, "the greatest step towards solving

the problem of aerial navigation of the age." Lamson, himself, on his day of glory, declared "I think the time is very close at hand when people will be sailing through the air. I think that time will be here inside of three years."

He missed his guess by some four years more, but it indicates that men were cherishing that hope of somehow "sailing through the air."

Meanwhile in Chicago for some years a quiet little man with an international reputation in the engineering world, had been persistently employing his analytical faculties in the search for that elusive formula which would explain Nature's great secret of how birds fly.

Octave Chanute was born in Paris, February 18, 1832, and at the age of 6 years had emigrated with his parents to New York. Educated for the civil engineering profession, the achievements of his long and industrious career include the erection of the Missouri river bridge at Kansas City, construction of the Kansas-Pacific Railroad, reduction of grades on the Erie Railroad, the designing of the Chicago Union Stock Yards, and a multitude of other tasks which won him recognition from scientific societies the world around.

In 1889 he settled in Chicago as a consulting engineer and president of a concern making a creosote preparation for the preservation of railroad ties and telegraph poles.

From early youth Chanute had been intrigued by the idea of flying. His new Chicago friends quickly learned that after business hours he was sailing kites amid the tin cans and ashes on the lake shore at Huron street. The fact of course established his reputation for being "queer." Associates laughed but, unheeding, Chanute in 1893 accepted the chairmanship of the Third International Conference on Aerial Navigation, held in Chicago in connection with the World's Columbian Exposition.

The papers read at this meeting, as collected in Chanute's book on "Progress of Flying Machines," dealt with such subjects as kites, parachutes, balloons, gliders, helicopters, and ornithopters, things which to the ordinary mortal in 1893 sounded decidedly irrational. They savored of something "impossible." But they show that men were earnestly groping in the dark for some practical pathway upward into the air.

For three more years Chanute flew kites, watched the birds and figured mathematical formulae which may be found among the papers given by his heirs to the John Crerar Library in Chicago. Continually grew his piles of letters from eager investigators everywhere. Continually he was adding to his collection of pamphlets on aviation in many languages. Continually he built tiny model planes which cluttered up the library of his Dearborn avenue home.

Chanute Hill at Miller, Indiana, as it appears today.

Then on June 22, 1896, six weeks after Langley's Washington demonstration, Chanute disappeared from his accustomed haunts, to turn up later in the sand dunes at the southernmost tip of Lake Michigan. With him on this historic expedition were A. M. Hering, his chief assistant, W. Avery, an electrician and carpenter, and William Paul Butusov, a former sailor. The purpose of the party was "to study the art of navigating an airplane."

The Indiana sand dunes have been built up by the wind and water through ages whose geological story can be read in the surrounding terrain. They extend today from Gary, Ind., eastward thirty or forty miles, around the big bend of the shore to the neighborhood of St. Joe, Michigan, and run inland from the water two to ten miles. In altitude they rise gradually until in places the crests of the golden billows are 200 to 300 feet above the water level.

Chanute wrote: "They are of soft, yellow sand, almost bare of vegetation and face in every direction of the compass, so that all directions of wind can be utilized in gliding experiments." Chanute Hill at that time had a height of seventy feet, he states.

Today this "Dune Country" has become famous like no other spot in America. Poets come to dream in its elusive atmosphere. Artists seek this shore hoping to catch on canvas the vagrant forms and changing colors of the ever shifting sands,

(*Continued on page* 107)

Residence of Octave Chanute, 1138 Dearborn Avenue, Chicago, where he died in 1910.

The Construction of Sailplanes

By Alfried Gymnich

Translated by John H. D. Blanke

(Continued from the October issue)

THE sailplane consists of the supporting works or wings, the fuselage or body, the control works, and the chassis or landing gear. The supporting wings are used to pick up and direct the air forces. They represent, therefore, the most important part of the airplane. The size of the supporting wings, that is, their surface area, is determined according to the weight of the plane and according to the useful load to be carried. This area is furthermore dependent upon the flying speed, for since the lift increases with the square of the flying speed, a fourfold lift may be attained by doubling the flying speed, provided that the angle of approach of the wings remains the same. However, since there is no motor-drive force in a sailplane, the speed can be influenced only by the aerodynamic design and by the load upon the surfaces or wings, within certain limits.

In airplanes with large, supplementary resistance, therefore, low flying speed, such as suspension or hanging gliders, re-enforced seat gliders, re-enforced biplanes, etc., the surface load must be kept low in order to attain the lowest possible sinking speed. In the case of aerodynamically high-grade sailplanes with high flying speed, the surface load can be greater without impairing the gliding angle, for, as we already know, the gliding angle of sailplanes is the resultant of the flying speed and of the sinking speed.

As a rule the surface load fluctuates, therefore, in the case of re-enforced or strutted sailplanes between 5 to 8 kg. per sq. m. or 1 to 1.6 lb. per sq. ft., whereas in high grade sailplanes it is between 8 and 12 kg. per sq. m. or 1.6 and 2.5 lb. per sq. ft.

The span or wing spread varies also very much. Biplanes have frequently a span of only 6 to 8 m. or 20 to 26 ft., schooling monoplanes one of 8 to 12 m. or 26 to 39 ft. and pure high performance sailplanes adhere in general to 12 to 15 m. or 39 to 49 ft., though a few machines have still greater dimensions. Thus, for example, the well-known sailplane "Konsul" had a span of 18.75 m. or nearly 62 ft. The side relation, therefore, the relation between span width and wing depth, is in schooling planes about 1:6 to 1:8, in high performance machines 1:10 to 1:15. This has its foundation in the fact that the aero-dynamic value of a supporting or carrying wing increases considerably under side relations to 1:10, and beyond that still increases slowly.

If we study the sailers among the birds, we will find that the albatros, the best sailer among the birds, has also the greatest side relations. The great span necessitates, however, a specially careful wing construction, for the construction weight of a free-carrying or non-strutted wing, one having no exterior braces, is not proportional to its span width, but increases rapidly with the span width, so that the advantage of a great span width, that is, a favorable side relation, is easily more than compensated by the great construction weight. The fundamental shape of the supporting wings is usually rectangular or trapeze-shaped, with rounded or reducing wing tips,

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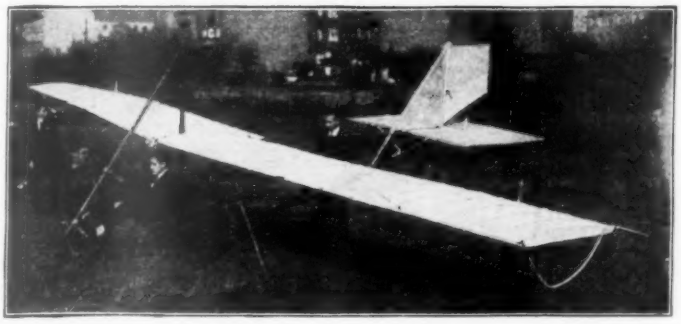

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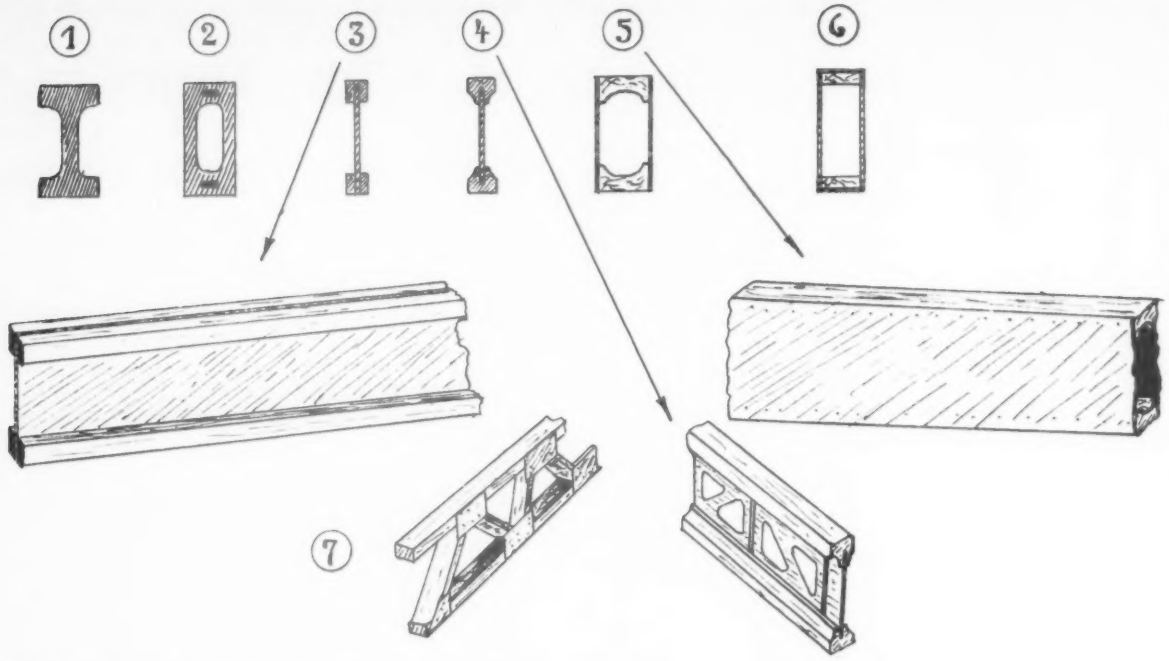
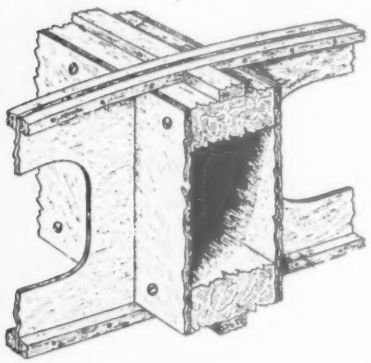


1—Beam cut from spruce; 2—Beam cut from spruce and glued; 3—"I" Beam with spruce plywood center and laterally glued-on spruce girths: 4—"I" Beam of spruce plywood with grooved spruce girths; 5, 6—Box-shaped beams; 7—Beam of bridge, ledge or built-up construction.

whereby the formation of detrimental eddies on the rim can be avoided.

Of very special importance for the flying qualities of a sailplane, as of any airplane, is the wing cross section, or profile. Thick profiles with considerably rounded entering edge and more or less marked concave arching of the underside are generally used in sailplane construction. Examples in this field are the researches of the aero-dynamic experimental station at Goettingen. Therefore, very frequently the profiles tested by this experimental station are being used. One finds the Goettingen profiles 441 and 535 especially frequently in the construction of sailplanes. The first one was used in the well-known sailplane "Vampyr," the latter one in the record sailplane "Konsul" and in others.

Method of fastening ribs to box beams.



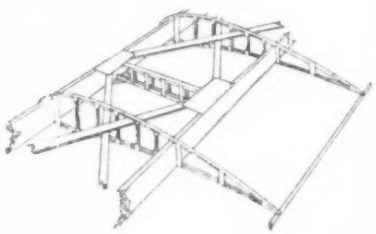
The upper and lower sides are less decisive for the qualities of the wing profile than the arching of the middle line, that is, the line running at a middle distance from the upper and lower edge curves of the profile. In the movement of the supporting wings against the air, a pressure effect is exerted against the underside, due to the adjustment of the supporting wings against the direction of movement, that is, against the direction of the current. At the upper side of the profile the stream lines of the air are pressed closer together, due to the shape given by the profile, which effects an increase in speed, which again is always combined with an under-pressure or suction according to the laws of aero- and hydro-mechanics. The upper side is therefore also suitably called the suction side and the lower side the pressure side of the profile. Suction and pressure combined form the resultant air force, which stands nearly vertical (somewhat inclined backwards) to the chord of the profile; however, the suction effect is about two-thirds and the pressure effect about one-third of the total force. According to the parallelogram of forces, the resultant air force may be divided up into two partial forces and that into a partial force effective vertically to the direction of the current or movement, and another effective parallel to this effective partial force. The first is the ascending force, briefly called ascent, and the second the resistance force, briefly called resistance. Both stand in a definite relation to each other, which is termed the R/A relation, or W/A relation in the German language. Concerning this we will speak again later.

Concerning the characteristics of the various profile forms one can say the following:

1. A strong arching or camber of the middle line of the profile results in high auxiliary ascent values.

2. At the same arching of the middle line the profiles with a thickness relation of 1:7 to 1:5 are more favorable than thinner wing cross sec-

Wing skeleton showing beam bridge and diagonals.



tions, due to their lower resistance. To this must be added that these profiles permit a free-carrying or non-braced construction, whereby the total resistance of the sailplane is reduced.

3. A slight bending upwards of the trailing edge of the profile has a stabilizing effect, but results also in a depreciation of the R/A relation, consequently a depreciation of the gliding angle. Within certain limits this depreciation can be compensated by means of elastic, therefore adjustable, trailing edges.

4. The streamline-shaped development of the entering edge of the profile, or the nose, results in a low minimum resistance.

5. The suction and pressure sides should be kept as smooth as possible, in order to attain good results; as can be done by avoiding the use of coarse impregnated materials, exterior fittings, instruments, etc.

6. The breaking or flapping of the trailing edge by manipulating the transverse rudder causes a cutting off of the air streams at small angles of adjustment and therefore a decrease in ascent. Therefore a special value is to be placed upon an harmonious passing over in designing the transversal rudder.

Depending on the construction, one or two beams are used for building the supporting wings, which are built of plywood planks or spruce girths in box form or I form; and also a number of ribs in the desired profile shape, which are pushed at intervals of 30 to 50 cm. or 11.8 to 19.7 inches across the beams and glued to them by the use of suitable corner ledges or plywood angles.

The greater the span width of the sailplane, the greater becomes also the lever arm under which the air forces act upon the supporting wings and the stronger must naturally also the beams be designed, for these form the actual backbone of the supporting wings. Besides a most exact figuring of the strengths of materials upon the basis of the resistance figures of the construction materials for the weights to be carried, under consideration of a safety factor, it is also advisable to determine the actual strength of a beam or of the beams by means of load tests.

The height of the beams is determined by the thickness of the profile and the latter again according to whether the sailplane is to be built with exterior bracing or free-carrying, that is, without exterior bracing. It is always suitable, even when the calculations for strengths do not require it, to utilize the full profile height for the construction of the beams, for the strength of the beams lies, above all, in its height.

If only one beam is used for the construction of the supporting wings, it should, as much as possible, be placed within the pressure center of the supporting wings. The beams are called, according to their location and dimensions, forehead-, nose- or visible-beam, front beam, rear beam and auxiliary beam. If the front beam is designed stronger than the rear beam, or if this relation is reversed, the stronger beam is called the main beam. The location and design of the individual beams is illustrated best in the drawings.

The shape of the ribs which serve to take up and transmit the air pressure forces to the beams is determined by the profile. The construction takes place fundamentally in two ways, either as plywood ribs with girthing or as ledge spars combined triangularly by the use of

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Skeleton view of sailplane illustrating simple construction.

variously shaped ledges of spruce. In construction, the plywood ribbing is more difficult and expensive; however, it is to be preferred to the ledge ribs, due to the greater strength. The ribs located at the wing joints and at the wing struts are frequently designed as box-ribs, since these can naturally take up greater forces.

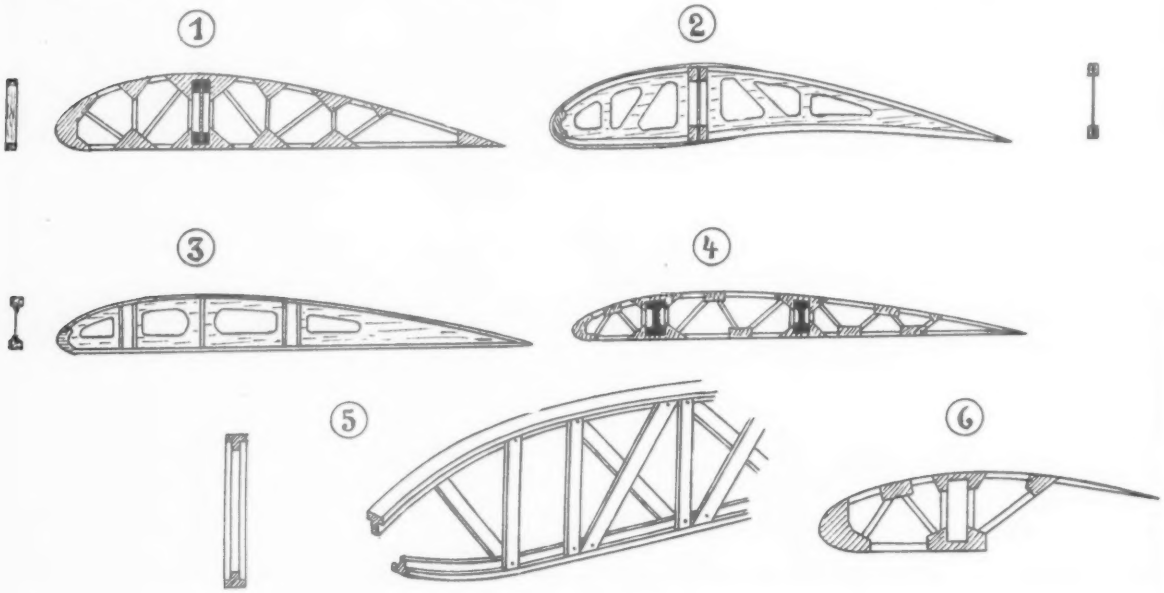
The shape and the construction of the individual ribs is shown in the illustrations. As already mentioned, the interval between the ribs is without exception 30 to 50 cm. or 12 to 20 inches. When greater intervals are used, auxiliary ribs are inserted in portions which in general reach only to the front beam or shortly back of it, in order to prevent a cave-in of the fabric covering and a therefrom resulting detrimental change in the profile.

Even though the beams form the backbone of the supporting wings, they do not, in their combination with the ribs, make the supporting wing into a rigid, torsion-resisting system such as is required for taking up the changing requirements in the flight. In order to attain the torsion-resistance of the wing-ribbing, the individual fields formed by the ribs and beams are provided with diagonal plywood sidewalls or ledge diagonals, or the entire front edge of the profile is planked above and below up to the front beam with very thin plywood and thereby formed into a torsion-resisting hollow body. The latter method is used especially in types using one beam, since they assure by way of relatively simple means an absolute torsion-resistance and an unobjectionable maintenance of the front edge.

The most dangerous cross section of the rib is located at the beam, and in the case of breaks, especially in wings having one beam, the break occurs right here as a rule. Therefore the rib girth is, at this place, frequently re-enforced with glued on plywood pieces, or special rib girths are used, which have at this place a wider cross section. Under all conditions it must be noted that the fastening of the rib girth to the beam, where a certain tension in the material occurs due to the arching in profile, should be done by glueing, and not by means of nails alone, since the girth will break at the nailing point even under the smallest strains.

In re-enforced or strutted airplanes with relatively thin profile the torsion-resistance is attained by means of the re-enforcing wires or the stays or struts, wherefore diagonal side walls or a plywood nose become superfluous. Here it is sufficient, if the distance between the beams is maintained by means of so-called distance tubes or by strong box ribs or beam bridges, to which steel wire diagonals are connected by aid of fittings in order to prevent a lateral displacement of the beams and ribs.

(To be continued)



1—Ledge rib with junction points overlapped with plywood; 2—Plywood rib with plywood planking; 3—Plywood rib with grooved girths; 4—Ledge rib with plywood reinforcing; 5—Easily constructed ledge rib with "T" girths; 6—Auxiliary rib for maintaining shape of entering edge.

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Name.....

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By Bertram Pond

THE designing and making of satisfactory propellers has been the downfall of more prospective good model flyers than any other part of their models. Fins, wings, elevators and frames are simple to most everyone, and the propellers will be too if you follow a plan such as given at the end of this discussion of propellers. Save these sheets and file them where they will be handy. The next time a friend, club member, beginner or a would-be old-timer seems to be ignorant of how to design and make a correctly shaped *true pitch propeller*, let him study this data.

The flight of the model depends upon the propellers. They transform the energy of the twisted rubber, compressed air motor or whatever power is used, into a forward thrust to overcome the drag of the whole machine. They should fit the machine perfectly, being neither too fast or too slow, nor too high pitch or too low pitch. If the pitch is close you will know by more excellent performance of the machine than with any other pitch.

Speed Is Constant

The theory to work upon with models is as follows:

$S=C\sqrt{WKy}$

S=Speed
C=A constant
W=Unit loading of the wing surface
Ky=Lift factor of the wing section at any given angle

Speed is proportional to the square root of the unit loading and the lift factor of the wing section. That is to say, any excess thrust will produce climb, but no difference in speed, for neither thrust nor drag enter into the speed formula! Insufficient thrust will only prolong a glide for this reason, and the speed will be the same as before. You will say, "Why do big planes have variable speed, if models do not?"

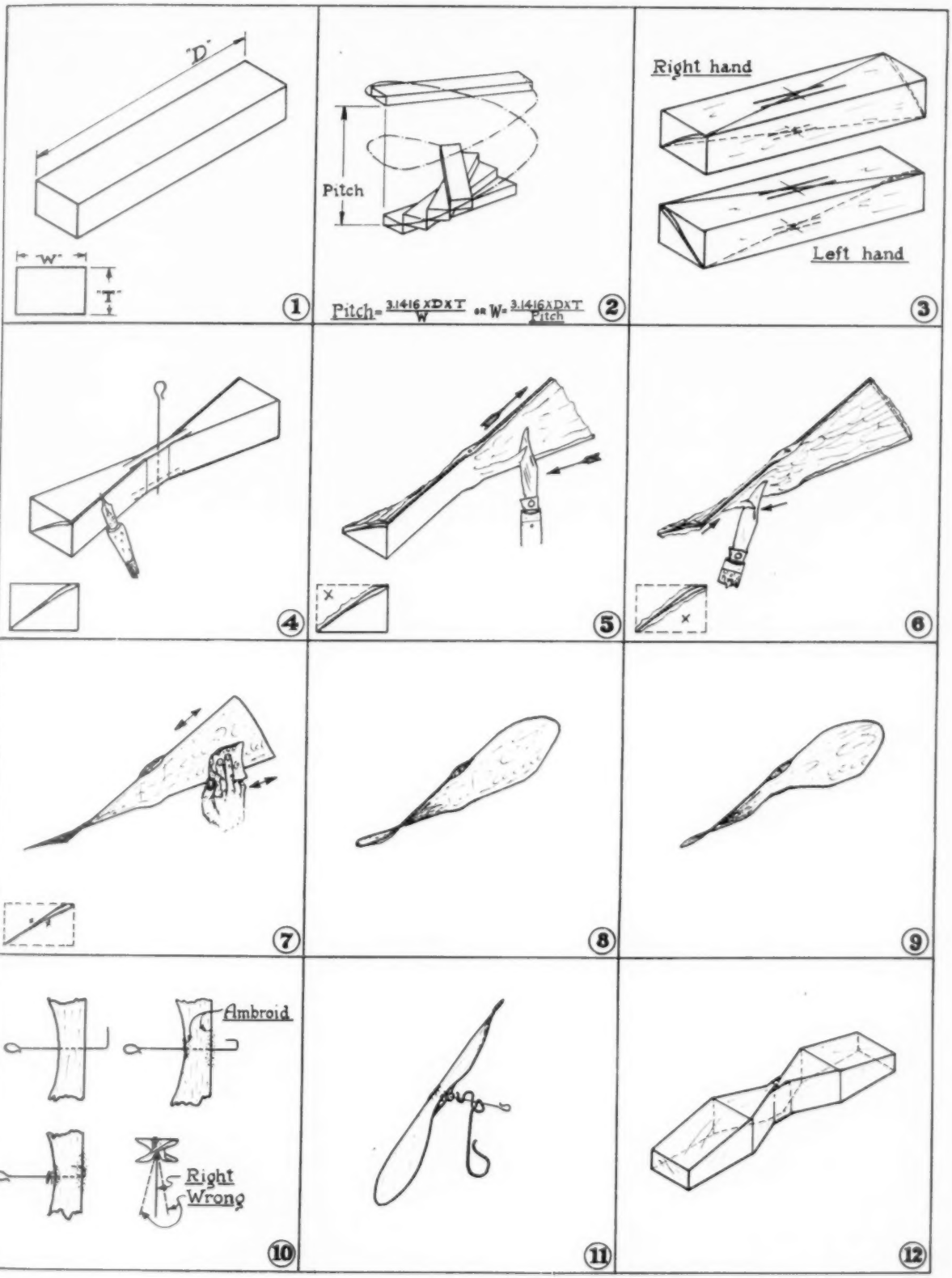
In big planes the pilot can reduce the Ky by nosing down, giving the reserve thrust to increasing speed, made possible by the changed Ky. In models the Ky is practically constant during a flight and so is the speed. An under elevated model flies faster than a correctly balanced model, but does so until it lands! There must be sufficient reserve thrust at the beginning of the flight to produce a fair climb. The ideal worked for in a duration machine is to properly balance the various factors of wing area, power, propeller area, pitch, etc., so that the rubber will be just unwound completely as the model lands.

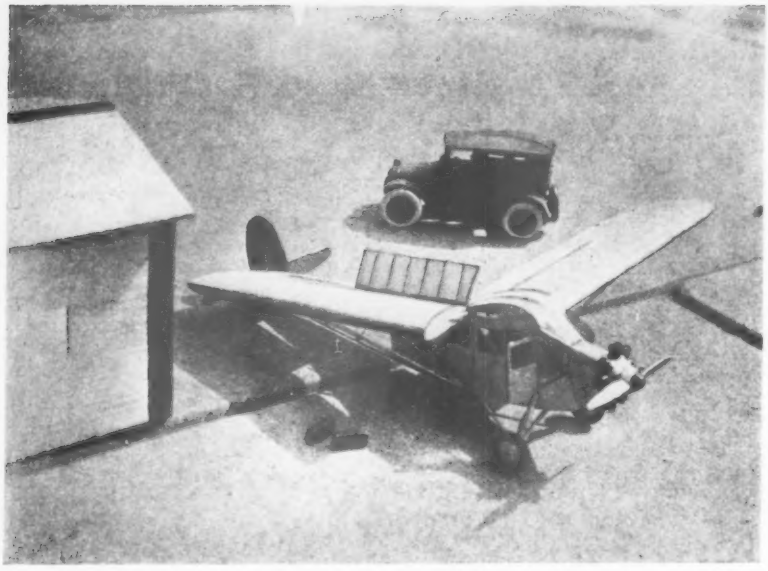
Revolutions Limited

Another factor to consider in model propellers is the very limited number of rotations available. Large airplanes use a low pitch to diameter ratio which is quite efficient with their practically unlimited revolutions. In a model we must make the pitch to diameter ratio greater, because we have very few turns available. The propeller alone becomes a little inefficient; but considering the limited turns available, the higher pitch to diameter ratio combined with the limited turns produces more duration by this compromise.

We strike a happy medium between propeller pitch and the limited revolutions to get a sturdy, efficient model. Lower pitch to diameter ratio propellers on a long, frail frame, with small rubbers, should give the best efficiency, since the pitch diameter ratio is best and a greater number of turns is available. Such models have made records; the Jaros and Lange planes and their more recent editions by Loughner, besides many others, being a few examples. (Lange's model was described in the December, 1928, issue of POPULAR AVIATION.) They are a little frail and require expert handling to prevent too many breaks and crashes. They have to be launched nearly full wound, even for trial, as they need some pep to gain a small altitude, after which they

How to Make Propellers





Folding wing Fairchild model by Tudor Morris.

become "floaters" and barely keep their altitude by the slow running props.

Future Records

Then we have the type which is coming into its own—the higher pitch ratio models. Here is the future record type. Rubber is the power. The more rubber we have, the more "horsepower" (or should I say "gnat power"?) we have. With this much greater power used only with fair efficiency, we can exceed in most cases the records made with the frail machines first considered if we use correct props.

High Pitch Props

A little higher pitch ratio with a little added diameter or blade width will slow the propellers up and yet maintain the speed of the model. (A more careful selection of wing section will often carry the added rubber weight on the same wing area!) The duration results will surprise you; yet your model will be sturdier. Mr. Lucas astonished the Detroit contestants last June by flying 11 minutes with this type of model. (The judges were unable to follow, and only allowed a little over 4 minutes.) The model editor has always worked along these lines with his own models and has found that stronger models can be made which perform as well, if not better.

Pitch Ratios

One to one ratio of pitch to diameter is low—the range of large plane propellers. A ratio of 1⅜ to 1 is used where a large number of turns of rubber is available on the lighter models. On the Lucas type, ratios of 1¾ to 1 are used very successfully with the larger motors. Two to 1 has been used a little and is worth experimenting with. One of the main advantages is that the larger motors permit I beam, angle and channel construction of frames which can be made lighter in proportion than the other frames for smaller motors!

It takes an expert constructor to reduce the drag of the rest of a model sufficiently so that the efficiency of these high pitch propellers will not be impaired. On twin pushers, double covered elevators help to accomplish this.

Higher pitch propellers require a slight camber, while low pitch props should be practically flat on account of the drag factor. Many original models have failed on account of too high pitch propellers on the light, long motor run models. Think of this discussion when building your next record breaker.

This discussion of propeller factors has led us into the general refinements of designs and combinations. Let's review the construction of the simplest true pitch propeller possible.

Construction

Refer to the drawing. Sketch (1) is the blank, with width "W," thickness "T," and diameter "D."

(2) shows what "pitch" is. Pitch can be defined as the height of a stack of blanks placed corner to corner (see sketch) in which the top blank is rotated one full turn from the bottom blank. That is the way the calculations are made! Pitch= 3.1416 × Diameter × Thickness divided by the Width.

(3) shows how to lay out a blank for carving so that the pitch is the same all along the blades. As the width becomes less, the diameter becomes less in proportion, so the pitch remains constant all along the blade. A lefthand layout is shown, as well as a righthand.

(4) shows how to cut out the sides of the blank preparatory to carving. Be sure to keep the guide lines straight. It is advisable to blacken

Paul Shifler Smith, holder of the world's record for rubber driven outdoor tractor models.

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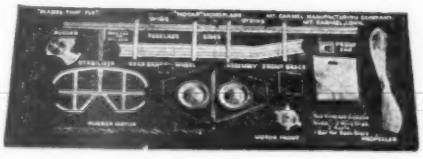
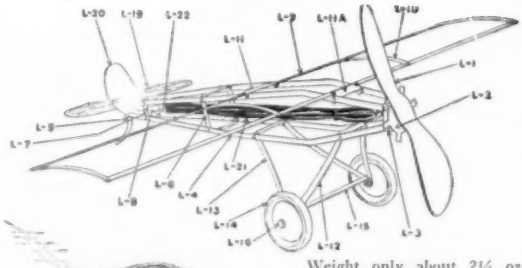
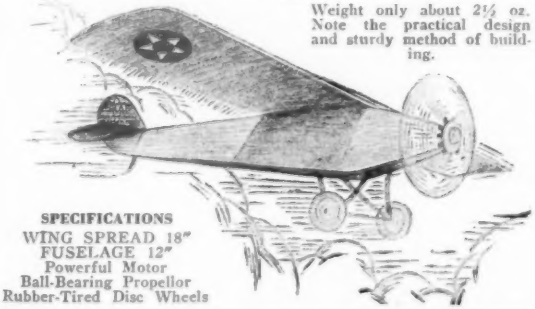


SET No. 1



Weight only about 2½ oz. Note the practical design and sturdy method of building.



SPECIFICATIONS
WING SPREAD 18"
FUSELAGE 12"
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Rubber-Tired Disc Wheels

THE "MOCAR" Monoplane is a practical, simply designed, real model airplane that *flies*. It is constructed of aluminum parts, all perfectly formed, ready for assembly. No special tools or punches needed for assembly—just pliers. All rivets, bolts, disc wheels, rubber tires, wing and fuselage covering materials are furnished.

When completed, this plane will actually fly, taking off from the ground. It is strong and will stand considerable abuse. Replacement parts are furnished at small cost.

This is an ideal model airplane that offers instruction in both airplane manufacture, and in flying. It is well to remember that all *real* airplanes are first tested by making *models*.

It is great fun to construct and fly "MOCAR" model airplanes

The illustrations above and to the left show skeleton assembly. All parts are plainly marked. Note the sturdy design. The weight, when completed, is only about 2½ oz. Full instructions and illustration for assembly are printed on the board to which the parts are mounted. Shipped complete in box.

The plane has a wing spread of 18", fuselage 12". A very powerful rubber motor, ball bearing propellor of special strong construction and rubber tired disc wheels. All parts made of aluminum.

Set No. 1 is modeled after Lindbergh's Spirit of St. Louis. Construction set, (Postpaid $1.50.) Model L made up ready to fly. (Postpaid $2.25.)

COUPON

The Mt. Carmel Mfg. Co.
Mt. Carmel, Conn.
Dept. P-11

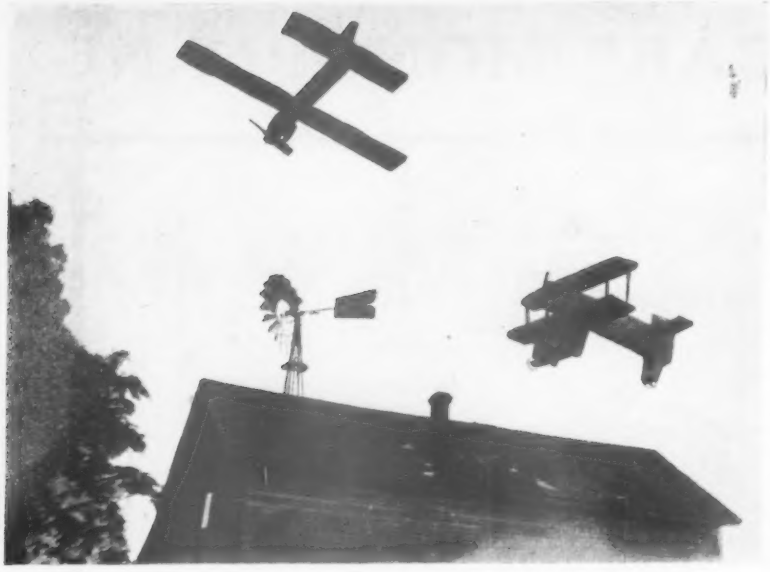
Dear Sirs:—Enclosed find $.....for which please send me postpaid the following items checked:

☐ 1 Set No. 1.....**$1.50** ☐ 1 Assembled Plane.....**$2.25**
☐ 3 Sets No. 1.....**$4.00** ☐ 3 Assembled Planes.....**$6.00**

Signed name.....

Address.....

P. O.....



Indiana barnyard view—like our first models!

the guide edge to help prevent cutting into the edge or sanding it. Mark these edges good and black!

Before the wood is all cut away it is very easy to pierce the shaft hole. Use the music wire shaft which you intend to install as a drill and insert it carefully into the soft balsa. Sight across the blank as you push the shaft through it to make certain it is straight. (It is not necessary or advisable to use a drill.)

(5) demonstrates the rough carving of a righthand prop face. Carve with the grain to prevent splits.

(6) illustrates the under side rough carved. Leave the blank lines untouched. Watch the hub. It should be left heavier than the rest of the blade.

(7) pictures the sanding operation. Sand up to the black lines by sanding parallel to them. Do not round tips until after the prop has been sanded first with coarse sandpaper and then with medium. Carefully gauge the cross section of the blades so that they will be about the section shown. You should be able to see a little light through the blades. Correct the balance of the prop by balancing on a knife blade and sand the heavy end until balanced. Smooth over the hub so that it blends into the blades. The rear of the blades is thin and the blades should taper from the thick hub to a thin section at tips.

(8) Cut the tips to the shape and blade area you desire. More work is done and more efficiency occurs at a point about 2/3 of the distance out from the center. Therefore it is better to make the blade widest at 2/3 of the distance out from the hub than at any other point. Use a suitable pattern (metal, cardboard, paper, etc.) for making the tips alike. In a pair of props be careful to get the tips symmetrical. A thick edge is left when the tips are rounded, so sand the top of the blades down. Balance the propeller very carefully at this point.

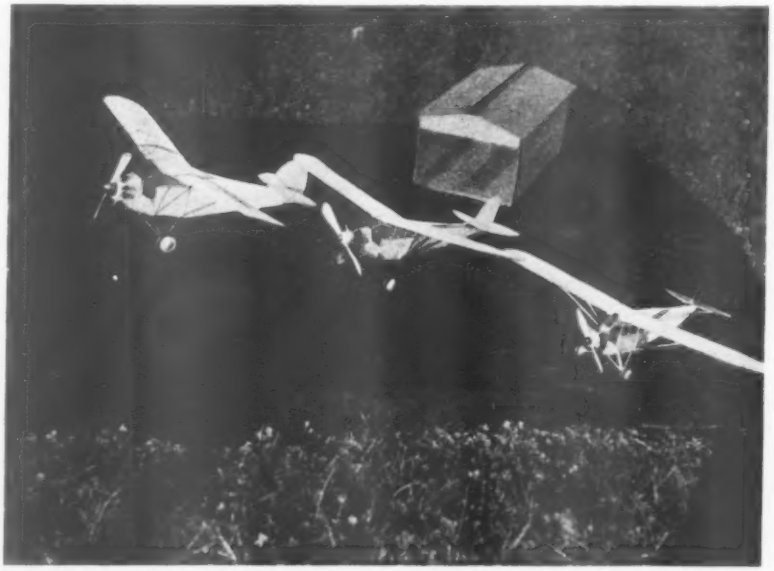
(9) Cut out the back side to reduce the weight. At least ½ of the thickness of the blank should be left for strength. Be careful not to make a weak place at the center. Sand these cut edges smooth. As the center is very inefficient as a propeller, this cutout will save quite a bit of weight.

(10) shows installing the shafts for tractors and pushers. Be sure that they are in straight. *Warning*—Ambroid the hub, or even glue a piece of bamboo under the "U" in the shaft to prevent the shaft from pulling through the soft balsa! Slip 2 or more small washers on each shaft.

(11) If dope is to be used, it should be applied at this stage of the construction. Three coats of banana oil with a very fine sanding between coats makes a good coating. Give the entering edge and tips several extra coats. Use a hook similar to the one shown for checking the final exact balance. Do this over a table in a corner where no air is stirring. Be sure the shaft is in the propeller straight. The propeller should balance at any position it is set at. The breath will even disturb balancing if you are not careful. A smooth flying model can be easily made by using care in balancing. A "shimmying" or vibrating propeller is a sign of carelessness.

(12) illustrates one method of making a true pitch "toothpick" style model propeller. This is an efficient type of prop and saves some wood. The pitch has to be calculated at only one more place. The width varies from the center out to the straight portion.

Left, Memphis 1st place winner—two events, Center, Peru, Indiana 1st place winner, Right, Detroit $100 cash prize winner.



From here on the thickness varies and the width is constant. This shape is quite often used by experienced model builders. Of course, the possibility of an error in calculations enters in here. This would make an undesirable varying pitch effect.

* * * * * *

There are many more refinements and helps on propellers in the model editor's data file on scale model props, adjustable pitch props, 2-piece props, featherweight props, hydro and speed props, 3 and 4 bladed props (or what have you?), but we will save them all until another time!

A $100 Prize Model

The model pictured is an accurately built up Fairchild of 24 in. wing spread. Such remarkable neatness and detail are worth describing, especially since it won $100 for Mr. Morris, its builder.

The wings are built up to fold back like the full sized machine. The ribs are all alike and accurately built up. The ailerons operate in the usual manner. The small scale of the miniature made this a fairly difficult part to model. It was accomplished by the use of a very simple and correct arrangement:

A small lever is mounted in a slot in the wing ribs nearest the body. This lever is connected with a bell crank out in the wing which operated the aileron with a push-pull rod on the under side. The lever, bell crank and aileron horn are made of hard sheet aluminum. The push-pull rods are of music wire with washers attached to take up play.

The body section carries two push rods of round bamboo. The levers in the end wing ribs are hinged at their centers. When the wings are in flying position these push rods in the body meet the ends of the levers so as to transmit any motion across the body to the other lever and the aileron connected to it, the same as in the big Fairchilds.

The fuselage is built up of round bamboo which resembles the round steel tubing of the body. The dummy motor is made from standard ½ dram vial corks set in the balsa wood nose. Bent pins are used for realistic valve push rods. Small radio "spaghetti" or varnished cambric tubing forms the intake and exhaust manifolds.

The seats are all leather trimmed and the pilot's seat is a regular metal bucket seat upholstered.

All doors are hinged. All windows are included on the model that appear on the real ship. The elevator and rudder are hinged to operate. The wheels and tires are to the exact scale of this equipment on the real ship. Even a miniature baggage compartment is provided, with two miniature suitcases to scale. The covering is of the finest China silk cloth stretched neatly in place.

The model folds to fit into a small hangar which can be carried under the arm.

With a total weight of only 1.5 ounces, it can be readily converted into a flying model!

Compare the Fairchild model if you will with the Indiana barnyard models pictured in the model section for a good laugh.

Recommended by the Boy Scouts of America—

MODEL AIRPLANES

How to Build and Fly Them

By ELMER L. ALLEN

With a Foreword by Dan Beard

A simple, complete and practical book that shows just how to build and fly Racing Models and *Facsimiles of Famous Airplanes*—including Lindbergh's "Spirit of St. Louis," Byrd's North Pole Trimotored Fokker Monoplane, etc. Each step is described so clearly that the planes may be made by any boy at home. There are a great number of diagrams, scale-reduction plans, and actual-size working patterns, with lists of materials required and the proper tools to use. By a well-known authority on the subject.

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Order V. R. Today
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BENDS QUICKLY WITHOUT BURNING

Landing Gears, Wings, Tips, Floats, Fins, Elevators, Body Formers, Etc. You will be surprised how easily it works. Postpaid with full directions. SEND $1.00 BILL NOW with your name and address to:—

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Commercial builders make their planes from Balsa Wood — it is the lightest wood known, yet weight for weight strong as pine. Its resiliency like that of spruce. We have Balsa Wood pieces cut in special width for the builder of model planes and gliders. Prices as below.

Prices Postpaid

Length	Width	Thickness	
36″	6″	2″	$1.25
36″	6″	3″	1.75
40″	5″	2″	1.25
40″	5″	3″	1.75
36″	6″	⅛″	.60

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327 So. La Salle St.

San Francisco, Calif.
245 11th St.

Write for our free booklet on model construction

Popular Aviation Awards

The second National Playground Miniature Aircraft finals were held at Atlantic City, October 5th and 6th, under the auspices of the Playground and Recreation Association of America. Many prominent and famous men and fliers are on the sponsoring committee. The National Committee sponsoring these annual tournaments are:

Orville Wright
Chairman
Colonel Charles A. Lindbergh
Associate Chairman
Porter Adams
President of the National Aeronautic Association of U. S. A.
Commander Richard E. Byrd
U. S. Navy
F. Trubee Davison
Assistant Secretary for Aeronautics, War Department
Henry Ford
Harry F. Guggenheim
President of the Daniel Guggenheim Fund for the Promotion of Aeronautics, Inc.
Clifford B. Harmon
President International League of Aviators
Joseph Lee
President of the Playground and Recreation Association of America
William P. McCracken, Jr.
Assistant Secretary for Aeronautics, Department of Commerce
Colonel Theodore Roosevelt
Edward P. Warner
Assistant Secretary for Aeronautics, Navy Department

Events

There were 10 events, five indoor and five outdoor, for each class (Junior and Senior).

Indoor Events

1. Gliders (a glider is an aircraft which is heavier than air and has no inherent power plant but derives its lift from the reaction of wind on its wings as it coasts through the air).

Duration of flight, hand launched (i.e., without use of catapult, sling shot, rubber sling, or any accessory other than the hands); not over 6 feet above floor. Each flight must terminate at least 20 feet from starting point—Junior Class.

2. Same as event number 1—Senior Class.

The following indoor events were for motor propelled airplanes, motive power carried in plane itself, tractor or pusher, not to exceed 30 inches over all in length or in span. All launchings to be not over 6 feet above floor.

3. Duration of flight, rubber motor only, hand launched—Junior Class.

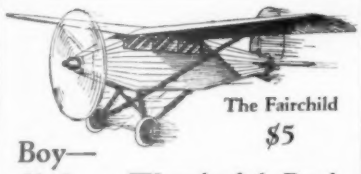
4. Same as event number 3—Senior Class.

5. Scale models, power optional,

rising off ground, for duration of flight—Junior Class.

6. Same as event number 5—Senior Class.

7. Type of power optional, rising off water, for duration of flight—Junior Class.



The Fairchild $5

Boy—
She's a Wonderful Bus!

Fly this genuine Clinton "scale model" plane and grab all the prizes! It has 22-inch, high-lift wing, all-metal motor mount and propeller, rubber-tired aluminum wheels. Will fly over 200 feet, dip, zoom, roll like a real plane. The Fairchild model shown above, the Fokker or the Spirit of St. Louis sent postpaid anywhere in the U. S. for $5.

ARMY SCOUT $3.50

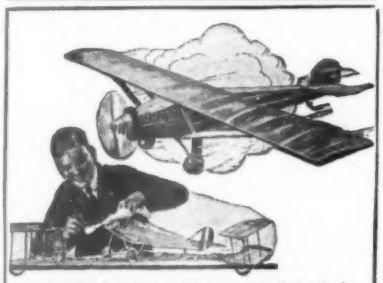
Army Scout Plane shown at left, or the Navy Scout, $3.50. All planes sent ready to fly, and guaranteed to do it! Order now.

Catalog and free glider 10c

The Clinton Toy Corp., Dept. F
North Haven, Conn.

Dealers and Jobbers, Write

CLINTON Airplanes



Build This IDEAL Flying Model of the "*Spirit of St. Louis*"

A PERFECT 3-ft. miniature of the most famous Airplane in the world! Anybody can build and fly it. The IDEAL Complete Construction Outfit contains everything needed; all parts, fittings and materials, full plans, diagrams and instructions. The Model is guaranteed to fly when correctly built.

COMPLETE CONSTRUCTION OUTFIT (West of Denver, Colo., and in Canada $8.00) **$7.50**

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Plans for Model Airplanes

Complete, accurate, ½-size Plans, with Building-Flying Instructions, for any one of the following: New York-Paris; FOKKER; Curtiss; DeHAVILLAND; NC-4 Seaplane; Bleriot; Taube or Nieuport; *EACH* Cecil Peoll..... Model Book Free with each plan. **25c**

64-Page Book for Model Builders

Contains plans for building Gliders and Racers; full information about Scale Models; and most complete catalog of Parts, Supplies, Materials and Fittings for all kinds of Models. Postpaid for..... **5c**

Ideal Aeroplane & Supply Co., Inc.
22-26 West 19th St., New York City

8. Same as event number 7—Senior Class.

9. Weight carrying. Ratio of weight of load to weight of plane only factor scored.

Scale models only; rubber motor only; rising off ground; minimum flight of 8 seconds to qualify—Junior Class.

10. Same as event number 9—Senior Class.

Outdoor Events

Motor propelled airplanes, motive power carried in plane itself, tractor or pusher; not to exceed 48 inches over all in length or span; all launchings to be not over 6 feet above ground.

1. Rubber motor only, hand launched; duration of flight—Junior Class.

2. Same as event number 1—Senior Class.

3. Any motive power other than rubber; type of launching optional; duration of flight—Junior Class.

4. Same as event number 3—Senior Class.

5. Scale models, rubber motor only, rising off ground; duration of flight—Junior Class.

6. Same as event number 5—Senior Class.

7. Type of power optional, rising off water; duration of flight—Junior Class.

8. Same as event number 7—Senior Class.

9. Speed, rubber motor only, hand launched; time taken from time of start till plane crossed finish line a straight line 300 feet away from start as measured along below mentioned bisector and drawn at right angles to the bisector of a 90 degree sector with apex at starting point. Flight with the wind—Junior Class.

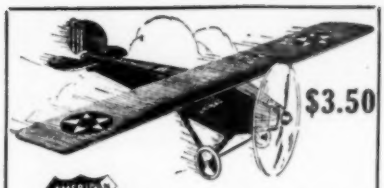
10. Same as event number 9—Senior Class.

* * *

"Scale models" is not a correct name for the models used in events Nos. 5 and 6, in either the indoor or outdoor divisions. Scale models are real, true copies of large airplanes (such as the Fairchild described elsewhere in this issue). "Fuselage models" is a better name as it implies models with motors enclosed in the fuselage, yet not real scale models.

The word "Commercial" is better left out of models altogether, as it is unnecessary and confusing since many different interpretations are placed upon it.

Prizes—To encourage this fine sport of model building among the youth of America, POPULAR AVIA-



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Designed Like And Flies Like a REAL AIRPLANE

Will fly several hundred feet and is extremely ***durable*** . . . good for many hundreds of flights without damage.

Has all-metal motor mount, sturdy wings, scientifically designed aluminum propeller and shock-absorber landing gear with rubber-tired wheels.

The Scout Model shown above, well packed, will be sent prepaid anywhere in the U. S. for $3.50. Other splendid American Models are: Spirit of St. Louis, Bremen, Fairchild, Fokker, etc. Every plane tested at the factory and guaranteed to fly and land like a regular plane. Order now and let the fun begin! Glider Given with Catalog 10c.

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COMMERCIAL TRANSPORT—A real job! And easy to build, too. Wire parts, balsa cut to size, round bamboo, Superfine tissue, Ambroid and everything complete, postpaid only $2.75, or $3.50 with ready carved propeller.

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AMBROID—Special $0.35 ordered alone. Only $0.28 if ordered with other materials.

RUBBER—Fresh stock, ⅛-in. flat, full skeins (about 200 feet), bargain price only $1.00 postpaid.

JAPANESE TISSUE—Big 21"x31" sheets, light and tough. Order 5 sheets, $0.30 postpaid; 10 for $0.55.

SUPERFINE JAPANESE TISSUE—Just discovered! Rare, extremely light and smooth—18"x24". Supply may not last long. Order 5 sheets, $0.55 postpaid; 10 for $1.05.

COMPRESSED AIR MOTOR—Oh boy! Make 5 foot real engine driven planes now! Powerful light 3-cylinder motor, only $4.90.

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ORDER NOW!

Build hydro models, featherweight record models, Spirit of St. Louis, Fairchild, etc., with our featherweight parts. You need our balsa spars, veneer, "I" beams, frictionless bearings, "dope", at bargain prices.

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Has a 36-inch wing spread and the finest streamlined features; correct split type axle; fittings; LINDBERGH type propeller and 9 cylinder Whirlwind Motor "Dummy." Blue print ¼ full size with complete instructions for building same. Guaranteed to fly if properly constructed. Postpaid, $8.50.

Nieuport Biplane	$3.00
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	Spruce	Balsa
¼"x⅛"x3'	.03	
¼"x 1"x3'		.06
⅛"x⅛"x3'	.03	.032
⅛"x¼"x3'	.045	.054
¼"x¼"x3'	.054	.06
½"x 1"x3'		.24
1"x 3"x3'		.48
1"x 3"x3½'		.56

Reed 6' lengths, ⅛" diam. .05c; ⅛" .075c; 5/32" .10c; Balsa discs ⅛" thick 2" diam. .07c; 3" .08c; 4" .09c.

Ambroid dope, ¼ pint .50; ½ pint	.95
Ambroid cement, 2 oz. .33; 4 oz.	.53
Bamboo paper 13x36" .12; 24½"x33¾"	.14
Rice paper, 18"x24, .09; 21"x25"	.06
Wood veneer, 20"x30"	.22
Flat rubber 50' of ⅛". .50; 50' of 3/16"	.75
Piano wire 3' of No. 5 or No. 8, .04; 3' of No. 11 or 15	.06
28-30-32-34 steel wire, per spool	.10
⅛" copper washers, 10 for	.05

We can supply any size balsa that you need, also propellers, I beams, wing sections, bolts, nuts, screws, brads, aluminum, brass tubing, turnbuckles and books on model building.

Ace E. Z. Built Spirit of St. Louis

39 Inch Wing Spread Flying Model

Can be built in 6 hours time by anyone. No steaming, drilling, nailing or drip drop glue joints needed. Exclusive ace E. Z. construction makes this possible. Complete with balloon tired aluminum disc wheels, split type landing gear, feather weight ball-bearing propeller shaft. Lindytype propeller with aluminum spinner cap, balsa wood wing ribs, aluminum cowling, full sized drawing. Demountable motor stick gives you distance flights.

COMPLETE CONSTRUCTION SET $7.00
COMPARE WITH OTHERS

Spirit of St. Louis

33 inch wing span with finished sides, inside pieces, streamline balsa disc wheels, balsa wing ribs, wire parts all formed, semi-finished propeller with spinner, and all that is needed to build this light machine $4.50
Materials alone for building this machine 2.00
Elliot racer with hydro equipment, special 3.25
C Model special offer, complete kit 2.25
Ace E. Z. bamboo bender; every model maker needs one. Simple, practical, bends any small or large radius—complete ..... .80
Or, when ordered with our kits ..... .70
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Y. M. C. A., Model Clubs, Jobbers, Dealers, Write for discounts.

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131 Prospect Street, Jersey City, New Jersey

TION has provided fitting cups and medals for the winners of this tournament.

Next issue of POPULAR AVIATION will give the results of this final contest. The Memphis contest last year was such a success that we feel a treat will be provided in the way of fine performances of the models and the sportsmanship of the contestants.

The following boys were qualified to enter all of the events in their class at Atlantic City, according to advices received from the Association just before going to press:

Juniors

Robert Atwater, Elmira, N. Y.
John Becker, Baltimore, Md.
George Bell, Washington, D. C.
George P. Bentley, Boston, Mass.
Douglas Bruce, Washington, D. C.
Daryl Crawford, Knoxville, Tenn.
John Dawson, Evanston, Ill.
Robert Duncan, Elmira, N. Y.
Alvin Fallert, Glendale, Cal.
Charles Guiner, Reading, Pa.
Edward Harms, Evanston, Ill.
Evans Klinger, San Francisco, Cal.
Elmer Kohl, Reading, Pa.
Robert Loper, Topeka, Kan.
Nathan Markowitz, Boston, Mass.
William Moffatt, Muncie, Ind.
George Novak, Detroit, Mich.
Edwin O'Donovan, Topeka, Kan.
O. Petroff, Montclair, N. J.
Charles Plasewicz, Boston, Mass.
Kenneth Raisor, Muncie, Ind.
Harley Rich, Knoxville, Tenn.
Thomas Robbins, Washington.
Ernest Stout, Washington, D. C.
Stanley Waselewsky, Boston, Mass.
Langfitt Wilby, Washington, D. C.
Melwyn Yohe, Parnassus, Pa.

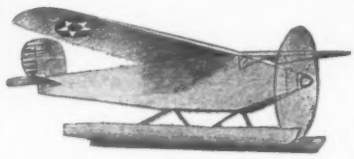
Seniors

Gerald Borchardt, Oak Park, Ill.
Harry Cone, Elmira, N. Y.
Herbert Dorsey, Washington, D. C.
Morey G. Frankel, Boston, Mass.
Lloyd Fish, Washington, D. C.
Ralph Hoeflich, San Francisco.
Robert Hyde, Elmira, N. Y.
Arthur Kronfelt, Boston, Mass.
Charles J. Klein, Baltimore, Md.
William Kuring, San Francisco.
Robert Leonard, San Diego, Cal.
Gustav Liljegren, Boston, Mass.
D. Lockwood, Chicago, Ill.
E. Miller, Chicago, Ill.
Ernest Marcouiller, Evanston, Ill.
Ernest McCoy, Detroit, Mich.
Tudor Morris, Peru, Ind.
R. Myers, Chicago, Ill.
Joe Osborne, Muncie, Ind.
Bud Perl, San Diego, Cal.
Virgil Rassner, Peru, Ind.
Harold Reed, Topeka, Kan.
Burton Simcox, Knoxville, Tenn.
Nat Zimberg, Detroit, Mich.

POPULAR AVIATION sincerely hopes that the weather was warmer this year than it was at Memphis or at the New York 1925 Air Race Model Tournament. October seems to be a little late in the season for the best outdoor model performance.

We sincerely trust that by next year some of the obvious inequalities and injustices in the rules of the Model Aircraft competitions will be adjusted. There has been much complaint regarding certain of the rules and a revision of them, with a better set of definitions and regulations is called for. Those who feel that model building is a distinct aid to aviation in the building up of air-mindedness among the youth of the country would like to see a uniform and equitable set of regulations governing these contests.

POPULAR AVIATION offers its services as a clearing house for ideas on this subject and pledges its support to any disinterested organization in this matter.



This Beautiful **$5.00**
"Twin Float"
RACING SEAPLANE

flies like one of the regulars and lands on the water as pretty as anything you ever saw! Has 23 inch high-lift wing, aluminum propeller and extra powerful motor. Pilot's cockpit in nose of plane. Same type as used by U. S. Navy. Sent prepaid anywhere in U. S., all ready to fly, for $5.00. Order today and get the big thrill of your life!

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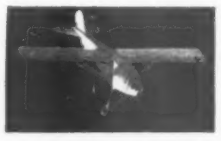
AIRPLANE 12-inch scale model of Lindbergh's Spirit of St. Louis. Scientifically designed and very realistic. Equipped with rubber band motor. Rises from ground by own power and flies 30 ft. or more. Easily built without tools. Construction set, with all parts and full directions, postpaid in U. S., only 50c (no stamps). Satisfaction or money back. Send now.



Mann & Benton, 53 W. Second St., Chillicothe, Ohio

Simple Aerodynamics

(*Continued from page 70*)

loss of engine power at high altitudes is that the cylinders do not receive as heavy a charge as they do at the ground.

The volume of a cylinder 3 inches in diameter, and 5 inches long is:

$$\frac{\pi \times 3 \times 3}{4} \times 5 = 35.3 \text{ cubic inches}$$

or 0.0204 cubic feet. On the suction stroke of the piston the cylinder is filled with the charge.

With standard air at sea level a cubic foot of air weighs 0.07651 pounds so the charge in this case is $0.0204 \times 0.07651 = 0.001565$ pounds.

At 14,000 feet the standard temperature is 9.1° Fahrenheit or $9.1 + 459.4 = 468.5°$ Absolute.

At sea level the temperature is 59° Fahrenheit or $59 + 459.4 = 518.4°$ Absolute.

The density of the air corrected for the change in temperature only is then:

$$0.07651 \times \frac{518.4}{468.5} = .08475 \text{ pounds}$$

per cubic foot (Gay Lussac's Law).

At 14,000 feet the standard pressure is 17.50 inches of mercury. By use of Boyle's Law we find that the density corrected for both change in temperature and change in pressure is:

$$\frac{17.50}{29.92} \times 0.08475 = 0.0496 \text{ pounds}$$

per cubic foot.

The weight of charge taken in at 14,000 feet is then $0.0204 \times 0.0496 = 0.00101$.

Since this value is only about 2/3 of that for sea level conditions we cannot expect the engine to develop its full power. It will develop even less than 2/3 of its sea level power because the friction losses remain the same while the power developed diminishes.

How High Is Denver?

A pilot intending to land or take off at Denver or at any other locality of high altitude will do well to find out what this elevation is, for the density changes with altitude, and density affects his landing and his get-away. The following problem will help illustrate this case. Suppose the pressure in some locality

(*Continued on page 124*)

Our Library and Yours

A RATHER wide variety of interests is covered by the books received this month. Adventure is represented in Miss Amelia Earhart's account of the flight of the Friendship, and in two other books telling the story of famous flyers and famous planes (Historic Airships, by Holland, and Heroes of the Air, by Fraser). Model airplane builders will be interested in a new book on design by Allen, and aerial photographers will welcome the comprehensive study of this science just completed by Winchester and Wills. A very clean-cut statement of the principles of Air Navigation and Meteorology is contained in a manual by Captain Duncan.

20 HRS. 40 MIN., by Amelia Earhart. 314 pp., illustrated. G. P. Putnam's Sons, New York: 1928, $2.50.

When the Friendship swam down through the fog into the harbor of Burry Port, Wales, on the morning of June 18, 1928, it completed one of the most interesting recent Transatlantic flights. Twenty hours and forty minutes had elapsed since the pontoons had dragged off the water at Trepassey, and of this period, nineteen hours had been spent in fog or above clouds. Stultz and Gordon were accordingly obliged to fly almost entirely by instruments, and the flight is of value to aeronautical science because it furnishes additional data on the possibilities and limitations of existing devices for aerial navigation. Public interest in the personalities concerned in this latest Transatlantic venture naturally centered about Miss Amelia Earhart, the first woman to make the crossing by air.

20 Hrs. 40 Min. records in considerable detail the whole course of the undertaking, from the invitations which Commander Byrd issued by telephone to the prospective flyers, on through the postponements and delays more or less incident to all ocean hopping, to the half-eaten sandwich Gordon chucked through the window as the Friendship throttled down to make port in Wales. On the actual Atlantic flight Miss Earhart did not participate in the piloting of the seaplane, and she was thus free to set down her observations somewhat fully in the log-book. This spontaneous writing, done in the midst of the flight, makes very convincing reading. Miss Earhart tells the story lightly. In her foreword she apologizes for not having produced a "work," and expresses the hope that "some of the fun of flying the Atlantic" has sifted into her pages. This point of view is maintained throughout the book.

The Atlantic flight is of course the climax of the story, but Miss Earhart gives a brief account of the development of her interest in aviation and her earlier experiences in flying. The last four chapters deal in a simple and constructive way with the problems and prospects of American aviation. Miss Earhart's enthusiasm for private civilian flying, and her recent demonstration of her own faith in it in one of its most ambitious forms makes her book a stimulating addition to the new literature of the air.

NEW BOOKS RECEIVED

Historic Airships—Holland (Macrae-Smith)	*$4.00*
"20 hrs. 40 min."—Earhart (Putnam)	*2.50*
Model Airplanes — Allen (Stokes)	*3.50*
Heroes of the Air—Fraser (Crowell—7th printing)	*2.00*
Air Navigation & Meteorology—Duncan (Koppel)	*3.50*
Aerial Photography—Winchester & Wills (Amer. Photographic Pub. Co.)	*10.00*

MODEL AIRPLANES: HOW TO BUILD AND FLY THEM, by Elmer L. Allen. Frederick A. Stokes, New York: 1928, W326, Price $3.50.

The construction and flying of model airplanes is one of the most absorbing hobbies boys can have, and the appearance of a new book, dealing in detail with all the aspects of this topic is naturally of interest to boys everywhere. Recommended by the Boy Scouts of America, Model Airplanes, by Elmer L. Allen, is a distinctly worthwhile book for model airplane builders. It is essentially a textbook, illustrated with diagrams, scale-reduction plans, and a large number of actual-size working patterns. The text is simple and clear. Mr. Allen's organization of his material will appeal especially to those interested in getting a clear understanding of the fundamental principles which govern all artificial flight. The second chapter describes the basic laws which make it possible for human beings to control flight. The author presents this matter with an unusual degree of sympathy for the elementary reader, and as a result, more mature students of aeronautics might also find these skillful definitions of primary terms illuminating.

After discussing the fundamentals of flying, Mr. Allen gives complete instructions for building a glider. The next chapter goes a step farther, and describes the construction of a simple pusher model, that is, a glider with a propeller attached in such a way as to push the plane through the air. In the following chapter a tractor model, with the propeller mounted at the front rather than at the back, is discussed, and throughout the rest of the chapters the author gives instructions, together with plans and full-size diagrams, for building racing models, Curtiss Jennies, battle planes, and various well-known types of transatlantic seaplanes and monoplanes. The last chapter contains some very useful information on the carving of propellers, and incidentally explains admirably exactly how propellers manage to do their work. Do you know what propeller pitch will best suit your Cecil Peoli racer, and which will function best on your scale-model of the Spirit of St. Louis?

AERIAL PHOTOGRAPHY, by Clarence Winchester and F. L. Wills, with a foreword by Sir Alan J. Cobham, and introductory notes by Sir Peter Clutterbuck and Sir Felix J. C. Pole. American Photographic Publishing Company, Boston: 1928, 236 pp. $10.00.

Last month we spoke of Ives' Airplane Photography (Lippincott), and issued a cordial welcome to this almost pioneer work in a rapidly developing field. We are very glad this month to announce another publication on aerial picture-making. Aerial Photography, by Winchester and Wills, is a distinguished book. Besides offering a very excellent presentation of the entire subject of airplane photography, the book contains ninety half-tone plates, illustrating the types of photographs which can be taken from airplanes, and uses to which these photos can be applied. The reproductions are extremely well done, and the whole book is a beautiful example of printing art.

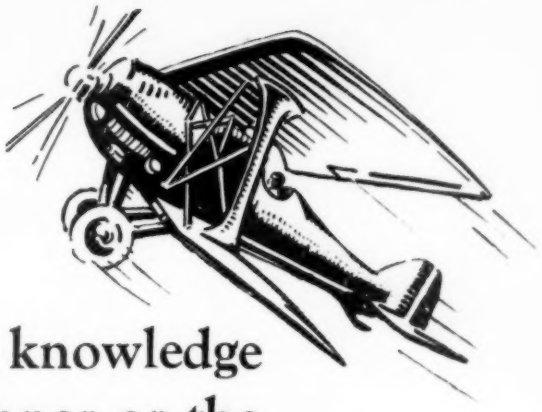
An attempt has been made to cover with some thoroughness the various aspects of aerial photography. After a preface, a foreword, and two notes on Aero-surveying of Forests and Aerial Photography in relation to Railways, there is presented a summary of relationship between aircraft and the camera. The rest of the book amplifies and develops the suggestions made in this introductory chapter. Photographic material is discussed in detail, together with types of apparatus. The chapters dealing with light values and atatmosphere, plates and films, lenses, filters, camera shutters, and the different sorts of cameras employed by the flying photographer are all remarkably interesting. Possibly most interesting of all are the chapters describing the application of aerial photography to warfare, industry, education, mapmaking, and archaeology. Amazing results have been obtained from air photos of archaeological excavations. A photograph of the ruins at Stonehenge, for instance, brought to light almost obliterated markings on the ground, tracings so faint that they had escaped the eyes of workers on the site itself. A number of similar instances are reported from different archaeological camps.

In dozens of ways aerial photography is playing a useful role in modern civilization. This book is an important contribution to an important field of investigation.

AIR NAVIGATION AND METEOROLOGY, by Captain Richard Duncan, M. C. Koppel Publishing Company, New York: 1928, 136 pp. $3.50.

Air Navigation and Meteorology can be a badly fogbound topic, as most students will testify. An attempt, therefore, to explain simply and carefully, and so far as may be in a non-technical manner, the mysteries of this science is a definite act of benevolence. Captain Duncan's textbook does not sacrifice accuracy in achieving its clarity, and therefore it stands as a distinctly important contribution to the cause of aerial tuition. The method of presentation is straightforward. After providing definitions for all technical words, whether they could be classed as familiar or not, Captain Duncan discusses maps and charts, and then proceeds to deal with magnets, magnetism, and magnetic poles. Having thus established the principles involved in navigation, the author tells of the airplane compass, and then passes to a discussion of all the airplane instruments concerned in

(*Continued on page* 114)



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Aviation Investments

By B. J. Meehan

J. Roy Prosser & Co., 52 William St., New York

THE most convincing evidence of the truth of the statement frequently made, that the Aeronautical Industry has passed through the experimental stages successfully and is now entering upon its greatest period of expansion, may be found in the alacrity with which the investing public is taking to the securities of this young, industrial giant of the future. Boiled down to its essence, the plain, unadulterated fact that the public is ready, and willing and even anxious to finance the great expansion now taking place and in prospect, is the best augury imaginable for the future.

Beyond question, new capital in abundance will be required to launch production on a quantity basis in order to satisfy the amazing demand for aircraft products that has developed during the past year, literally swamping the producing capacity of the industry. The well entrenched companies such as the Curtiss Aeroplane & Motors and the National Air Transit recently raised additional capital. Moreover, several new companies such as the Transcontinental Air Transport, Inc., have been organized.

While many of the pioneer manufacturers who started in a small way are still financing expansion through the slow process of reinvesting earnings, unfilled orders are piling up to such a marked extent, throwing delivery schedules back a full year in some cases, that the time does not appear to be far distant when they will be obliged to recapitalize or perhaps merge with larger units in the field in order to more effectively handle the large volume of business on hand and in prospect.

Throughout the experimental stages, the industry has been almost entirely financed by the original pioneer manufacturers. They alone, with perhaps some local backers in isolated instances, were willing to underwrite the large initial risks involved. Quite a few of these companies have been forced to rearrange their original capital structure for the purpose of obtaining some additional capital through local channels. As yet, there have been comparatively few fair-sized public offerings.

As a matter of fact, the industry is still honeycombed with moderate-sized privately owned (close) corporations. In time many of these concerns will undoubtedly be replaced by larger corporations with more flexible capital structures, the better to provide for future growth.

That is what actually took place in the development of practically all of our major industries. Notable examples are to be found in the motor and public utility industries. Through merger and various recapitalizations many companies with small beginnings have grown to be large corporations, vested with a wide public interest, whose shares are traded on the New York Stock Exchange, with ownership scattered all around the world.

Letters are beginning to pour into the office of Popular Aviation asking for information about the various stocks that are offered to the public. Facts about most of the issues are contained in "Answers to Investors."

This picture, as applied to the aviation industry, may seem rather far-fetched at first glance, but it is an entirely logical one, to visualize, if we dwell for a moment, on the vast possibilities ahead in the commercial development of the airplane, as yet only vaguely appreciated. Surely on the basis of the rapid strides made this year, it is hardly a mere flight of the imagination to picture the development of this great industry as paralleling that of the automobile and, like the latter, achieving the position to which it seems to be destined, as the third powerful arm in our transportation scheme.

It has been truly said that transportation is the backbone of our industrial development, and what greater proof need we have than the opening up of vast stretches of our own country when the trail of the "Covered Wagon" was replaced with steel rails. And more recently, the development of our public highways, made imperative by the advent of motor buses.

Imagine the air mail, passenger and express routes of the future which in time will very likely be operated by large transportation units cooperating with the railroads under air franchises and regulations of the Department of Commerce. Or perhaps a government agency similar to the Interstate Commerce Commission, may be set up, prescribing equitable rates allowing a fair return on invested capital in exchange for the monopolistic protection afforded by an exclusive franchise over certain routes to guard against unfair or unwarranted competition.

Then there is the pressing need for more adequate airports, suitable hotel accommodation, and improved transit facilities between air terminals and business centers, all of which will require a tremendous amount of new capital to keep pace with the demand for such services.

The law of experience decrees that the greatest profits rightfully belong to the pioneers. Of course, it is to be realized that practically all aeronautical stocks are still speculative, to a greater or less extent, with comparatively few dividend payers. Also, that by the very nature of things, there are bound to be drastic changes in such a young industry. Yet, the risks in investing in the industry today are hardly comparable with the man-sized financial risks that were shouldered by the very early pioneers, before the practicability of air mail, passenger and express service was definitely established.

By far, the airport and transportation branches of the industry promise to develop greater stability of earning power than the accessory, plane and engine manufacturing branches, and for that reason it may be desirable for the more conservatively inclined to favor the securities of the former. Yet, where the risks are greater the profits are usually commensurately larger. In any case the principle of diversification holds good. By acquiring equities in all branches of the industry and further distributing the funds among several issues in each branch, the risks

would naturally be lessened. There are several issues now traded in that combine the advantages of broad diversification on the order of the investment trust of the management type. Such issues are particularly suitable for the moderate-sized investor.

In the final analysis, the real profit opportunities are frequently found among the securities of the moderate sized, close corporations which have not as yet been recapitalized on a basis that wholly or partially discounts the immediate future prospects. Such issues are not generally so well-known to the investing public as the shares of the larger corporations which, in some degree, are vested with a public interest, by reason of a public offering and listing on an exchange.

Discerning investors generally seek closely held securities before they are recapitalized and while they are still traded Over-the-Counter—a sort of priming market that develops naturally as a result of the operation of the law of supply and demand.

The widespread interest that has developed recently in the shares of representative aeronautical companies traded in the over-the-counter market resulted in the daily publication of current quotations on all the over-the-counter pages of the leading New York papers.

Answers to Investors

(The following information has been compiled from sources which we believe to be authentic. Inquiries should bear the name and address of the writer. Only such inquiries as are of general interest will be published. Others, if accompanied by stamped and addressed envelope, will be answered by mail.)

C. M. D.—The Curtiss-Robertson Airplane Manufacturing Company was organized the latter part of 1927 with a capitalization of $500,000 in per cent preferred stock (100 par) and 30,000 shares of common (no par value). Fifty per cent of the stock is held by the Curtiss Aeroplane & Motor Co., Inc., Garden City, L. I., N. Y., manufacturers of the Curtiss-Robertson "Robin," in the medium priced field. Curtiss affiliation considered a valuable asset. Units are selling around 130.

J. A. L.—Western Air Express was incorporated in 1925, in California. This company has a capital stock of $420,000, $100 par common stock, on which annual dividends of $8 per share have been paid. Tangible assets are believed to be over $570,000 with net earnings understood to be about $30,000 monthly. The company operates the service between Los Angeles, San Francisco and Salt Lake City. Shares are at present selling around 230.

A. L.—Fokker Aircraft Corporation was organized in 1927 with 40,000 shares first preferred, $25 par, 30,222 shares outstanding; 20,000 shares second preferred, $25 par, all outstanding; and 100,000 shares common, no par value, outstanding. The company was formed to take over the Atlantic Aircraft Corporation at Hasbrouck Heights, N. J., manufacturing Fokker designed airplanes since 1923. New plant recently erected at Glendale, W. Va., and leased to company under purchase option. Plans announced for factory near Los Angeles. Unfilled orders said to be sufficient to maintain capacity operations into 1929, and estimated at $4,000,000. First preferred selling around 15, and common around 14½.

J. N. T.—We can obtain no information from the manufacturer you mention, and the withholding of such

Aeronautical Stocks

We specialize as dealers in the securities of representative companies in the aircraft industry and at present have orders to buy and sell the following:

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Alexander Industries, Inc.
Cessna Aircraft Co.
Fairchild Aviation Corp.
Fokker Aircraft Corp.
Lockheed Aircraft Co.
Swallow Airplane Co.
U. S. Air Transport Co., Inc.
Western Air Express, Inc.
Mahoney (B. F.) Aircraft Corp.
National Aviation Corp.
Aeromarine-Klemm Co.
Curtiss-Robertson Airplane Mfg. Co.
Warner Aircraft Corp.

We have issued a circular giving a brief resume of each of the companies which will be sent upon request.

Inquiries for market quotations will be given prompt attention.

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information is your cue to delay investment until a comprehensive statement is furnished you.

C. L. R. The Bellanca Aircraft Corporation of America was organized in 1927 with $1,000,000 capital. The company produces a closed cabin monoplane, employing one Wright "Whirlwind" motor as the power plant. Financial statements are not available, but an official communication announces that orders for 300 C. H. planes have been booked. This assures full production to January 1, 1930. The company owns all the models and patents of G. M. Bellanca. Several of the du Pont family are understood to be financially interested. The company contemplates the formation of sub-companies to produce other types of planes. Units, consisting of one preferred and one common, selling about 115.

D. M. K. The Mono Aircraft, Inc., with plant at Moline, Illinois, are makers of the Monocoupe. This is a low-priced cabin plane, powered by a single 70-80 H.P. Velie radial motor. Detailed information as to the financial condition of the company is not available, but shares are presently selling around 32. Production schedules, according to the latest reports are understood to have been doubled from 50 to 100 machines per month.

K. M. L. The Alexander Industries, Inc., manufacture Eaglerock airplanes, powered with Curtiss 0x5 engine and Wright "Whirlwind" motor. The company's new plant at Colorado Springs, consisting of ten buildings, is practically completed. In 1927 Alexander Industries ranked second in output of airplanes in the United States. The 1927 gross income was $1,338,452 as against $857,626 for 1926. The net income was $144,530 as against $115,560 in 1926. During the first four months of 1928 sales showed a 61 per cent increase over the same period in 1927. The company's financial condition was strong at the close of 1927. Preferred is selling around 100, and common around 6½.

M. F. S. The Fairchild Aviation Corporation was incorporated in December, 1927, and represents a consolidation of seven aircraft and accessory companies with a paid-in capital of $1,553,550 classified as 80,175 Class A no par shares of an authorized 150,000 share issue and 30,000 Class B no par shares of an authorized 50,000 share issue. The Class A stock enjoys preference as to assets and cumulative dividends of $1.20 per year. Earnings in excess of this figure are divided equally between Class A and Class B

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Financial Survey

(Continued from page 72)

found they had squandered their money in some of the so-called schools. Both students and the public at large can be benefited in the matter of safety by giving their wholehearted support to the standards of the Curtiss Flying Service Schools.

There is a growing conviction among that class of investors "who investigate before they purchase," that national aviation offers one of the safest channels for investment in the entire field. It is a holding company and is already participating in a number of prominent underwritings. Among its holdings are National Air Transport, now quoted 240 to 300; Curtiss Flying Service and Sikorsky Aircraft. These are only a few of a very satisfactory list of investments. It occupies a strategical position for securing at initial prices the best offerings in this industry. Stock was originally put out at 23½. It is now quoted 38 to 38¾ (Oct. 8th). Its management and directors include many of the most prominent names in aviation, banking and industry.

Aviation Corporation of America promises to be the most extensive transport system on the western con-

tinent, providing a service over routes in many instances not served by railroads and to a large extent in countries where flying weather is ideal. The mail carrying, as well as its passenger, freight and express facilities, will soon extend beyond Miami to Cuba and Porto Rico and Haiti to Panama, Venezuela, Valparaiso and many other points in South America, as well as to Mexico and Central America.

Among the officials and directors are Richard Hoyt of Hayden, Stone & Co.; J. T. Trippe, president of Pan American; Cornelius Vanderbilt Whitney; Lyman Delano, executive vice-president of Atlantic Coast Lines; S. M. Fairchild of Fairchild Aviation; Grover Loening of the Loening Amphibian; W. H. Vanderbilt, etc. The company already has a number of three motored, 12 passenger planes. This number will be substantially increased in the immediate future.

The newspapers have just advised the public as to the new air routes carrying passengers and mail to Canada and to Mexico. There are now in operation the Chicago to Montreal route, taking ten to fifteen hours elapsed time, and Chicago to Mexico City, with thirty-five hours of elapsed time; also New York to Montreal.

Pullman service from New York to San Francisco, with an actual 30 hours of flying, is soon to be started.

Canada is opening up her vast hitherto inaccessible territory on an elaborate scale. This particularly applies to lumber, oil and mining regions, which they did not expect to develop for perhaps another twenty-five years, owing to remoteness and lack of transportation.

The development of larger vehicles with higher cruising speeds is the order of the day, and capital is giving its hearty support to big plane departments. Nine different aircraft manufacturers are now bringing out planes to carry all the way from 18 to 25 passengers. The new Zeppelin dirigible will have started from Germany on its way across the Atlantic carrying many notable passengers before this article is printed.

While investigating investment opportunities connected with aviation, do not overlook the fact that several instrument companies offer an attractive field.

The demand for accurate instruments is universal and imperative. Every craft that flies needs several. Pioneer Instrument, Consolidated Instrument, particularly have capable managements and constantly growing earnings. In the discussion following Lieut. Hegenberger's highly interesting paper in the National Aeronautical Safety Conference the writer asked the lieutenant if it was not true that the most needed instrument was an adequate ground speed indicator. He answered, "Yes, and a non-barometric altimeter." This reply opens up possibilities to the instrument making industry that should be capitalized. We are informed that there are not any adequate instruments covering the above functions on the market today.

In closing, a banker has this to offer: "Don't buy aircraft stock on margin. Select carefully, buy outright and put your stocks in the strong box and let them mature. That is the way many of the wealthiest depositors have made their fortunes in their investments. Don't be a 10 per cent piker. The air is above you. It is the greatest time saver the world has known; and time is service, comfort and achievement."

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POPULAR AVIATION

608 S. Dearborn Street, Chicago, Ill.

Radio Department

Edited by Lloyd Jacquet

FAST as has been the development of aviation, it is dependent to no small degree upon the progress being made in the development of allied accessories, such as motors, fuselages and wings, fuel, and radio. Because of the increasing necessity for the pilot to be well informed on meteorological conditions immediately and accurately at all times, radio fills a peculiar place in the future advance of aviation and its greater utility and reliability.

So different are the requirements of communication from plane to ground, and from plane to plane, that special apparatus has had to be studied, designed and built exclusively for aviation purposes. Practically all new branches of radio engineering have been opened up, and some of the country's best radio engineers are being called upon to solve the problems presented to them by progressive pilots.

Besides the necessity for the rapid compilation and dissemination of reliable information to the aviator while he is in flight, the need for instruments that will permit his carrying on even in adverse weather is more and more apparent. This is the second, and most important role of radio as applied to aviation. Radio engineers have given aviators the directive radio beacon, which made possible the first successful flight to Honolulu last year, and the visible vibrating reed radio course indicator, that makes flying without the aid of compass and identifying ground marks a present-day actuality.

Further applications of the radio art to aviation will undoubtedly follow. Greater progress will be the result. It is the purpose of this new department to cover every month, in a general, non-technical way, the progress made in the radio art, as applied to aviation, as well as to cover striking uses and achievements of one of the air's most important adjuncts.

—THE EDITOR.

* * *

Probably the most important expedition ever fitted out, from the viewpoint of aviation and radio, started on its journey last month. Commander Byrd and his extensive party are on their way to the South Pole, with three planes, and complete radio equipment, among a mass of other supplies and devices calculated to bring to a successful end one of the famous flier's most ambitious projects.

The man who so successfully flew over the North Pole, and who used his radio transmitter then to give the news to the world naturally paid a great deal of attention to the radio installation on board his planes, and to the base stations that are to communicate with them. In polar explorations, radio is the only means of distance communication really available. This was proved in the case of the Italia.

Capt. Bonelli, navigator and radio-operator on the Roma, demonstrating method of placing retractable generator in service position.

Broadcast installation on an airplane for rebroadcasting from the air.

As the need for radio apparatus in exploration is greatest in case of distress, and as the usual type of airplane installation is made primarily for use while everything is well on board, it is interesting to note the differences in design incorporated in the planes of the Byrd expedition.

The power to drive the radio generating apparatus is derived from small wind-driven generators, swung out of the fuselage, or hanging from one of the wings or struts. This is the standard method. The propeller is driven as long as the ship is in flight. But once it becomes necessary to land, the radio instruments must remain silent, because of the lack of driving power. This is the thing that happened to Commander Rogers, and his seaplane, the PN-9, when it was forced down not far from the shores of Hawaii, and though it could hear ships searching and calling for it, it could not answer.

In all, Byrd is carrying four generators with him. Two will be driven from the main plane motor plant. Provision is made for these generators to be wind-driven also. They naturally would be useless,

however, if engine trouble forced the landing, for there would be no power available to turn them over either. Providing them with a motor drive multiplies their real emergency utility but slightly.

To prepare against this contingency, Byrd is taking along two small sets that have their own power plant, a diminutive gasoline engine, placing the generation of energy on a basis altogether independent from the two doubtful factors used heretofore.

If the plane equipped with one of these generators should be forced to land, communication can be easily set up by starting the tiny gasoline power plant, and transmitting the messages. The designer of these gas motors anticipated the possibility of their freezing tight, or being too cold to turn over. The construction is such that the engine can be propped up by means of legs, so that a warming fire can be applied under it!

Preparations such as these may seem exaggerated, but show to what extent Byrd has studied his problems, and how precarious even radio communication can be at the South Pole.

The plane transmitters will be about thirty inches high, and twelve inches wide, and the associated generator will be in similar proportion. Wavelengths of from 33 to 92 meters will be used for ordinary plane to base communication. Longer waves of from 400 to 675 meters will be set aside for compass and geographical work. It is possible that Byrd's radio engineers may learn some new facts about wave propagation in the Antarctic. The success of Byrd's diminutive radio communication system depends somewhat on that possibility too!

Three powerful base stations, complete as to sending and receiving equipment, will be used in the network of the expedition. Two of these base centers will be on the ships, and the third will be erected on land. Short waves will carry the news to the United States. Radio will receive its first extensive test of usefulness here.

* * *

The Italia disaster is now a closed chapter in the history book of aeronautics. Among the mass of controversial material regarding the tragic end of General Umberto Nobile's expedition, the part played by Guiseppe Biagi, the wireless operator of the polar dirigible is clear-cut and splendid.

Biagi was one of the survivors of the Italia crash on the ice of Franz

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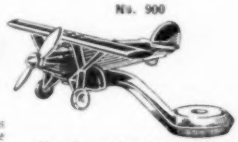

No. 900

No. 900. Same as No. 700 with the addition of a bracket to carry the plane forward to allow for motometer or other design on the radiator cap. **Price $1.50 each, postpaid.**

No. 850

No. 850. Here is the Lone Eagle—a truly artistic ornament. The Spread Eagle above is a work of art, added to the graceful bracket carrying the "plane of destiny" the ensemble produces a striking effect. **Price $2.50 each, postpaid.**

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Josef land, last May. He quickly salvaged what radio apparatus he could from the wrecked gondola, and worked for a long time, first on the receiving set, then on the transmitter.

It took infinite patience to straighten out wires, repair broken connections, flatten out crushed coils and condensers, and replace smashed tubes, all with the most limited of equipment. An antenna made from two pieces of the dirigible's tubular framework, mounted on one of the compass supports, brought in signals within an hour after it was erected. Almost a half day later, he was able to send signals, which were not heard by the rest of the world for several days.

A storage battery supplied the current to run both receiving and sending sets. Although news was flashed for weeks, the installation worked practically up to the time of the rescue of the marooned party.

A gold medal has just been presented to wireless operator Guiseppe Biagi by his American admirers, the Veteran Wireless Operators Association. In a simple, dignified, but brief ceremony, David Sarnoff, an old-time wireless operator, now vice-president of the Radio Corporation of America and a prominent member of the Association, presented the medal to Doctor Commandatore Emanuel Grazzi, Italian Consul-General in New York, who accepted on behalf of Biagi.

Biagi is now back home in his little village, practically within the shadow of the huge San Paolo wireless station.

* * *

As an example of a modern and well-designed installation on board a plane, the apparatus for receiving and sending placed on board the Roma, a curious sesqui-plane designed for Cesare Sabelli by Bellanca, is of great interest.

The problem imposed upon the engineers who had in charge the installation of the apparatus was to provide adequate communication possibilities for the ship while in a trans-Atlantic flight along the so-called Southern course. Bellanca, the designer of the plane, objected somewhat to the wind-driven type of radio generator, contending that the wind resistance as well as the "braking" effect of the generator when it is used for transmitting cut down the speed of the ship as much as several miles an hour.

An ingenious swinging generator, mounted on a special frame so that it could be drawn in when not in use, was devised and mounted in the section of the fuselage where the radio instruments were located.

All the power necessary to run the transmitting set is derived from the generator. A self-adjusting propeller of the single-blade type is used. It is rated at 75 watts output, a comparatively low power for a transmitter for this work.

For the antenna, the familiar trailing wire, with a streamline weight has been designed. It is used for both sending and receiving. The transfer is done automatically when the operator presses the flame-proof key to transmit the message.

A special receiving set, running on small dry batteries as storage units is fastened on a shelf, near the large gasoline tank completely insulated from shock by means of rubber absorbers. This comprises the balance of the equipment. Altogether, the outfit weighs ninety-six pounds, or a little more than 10 gallons of gas.

Two wavelengths are provided for, 45 meters to be used in communication with land stations, and 600 meters for ship traffic. The usual transfer switch, antenna reel, generator switch, and other equipment is included.

Elaborate plans have been made for the reception of the plane's signals. Transmission will take place every fifteen minutes of the hour. Land and ship wireless stations will be on the lookout for the signals.

Although the range of such an installation is indeterminate, it should be able to communicate reliably over a distance of several hundred miles, and may achieve extreme distances of a thousand miles or more.

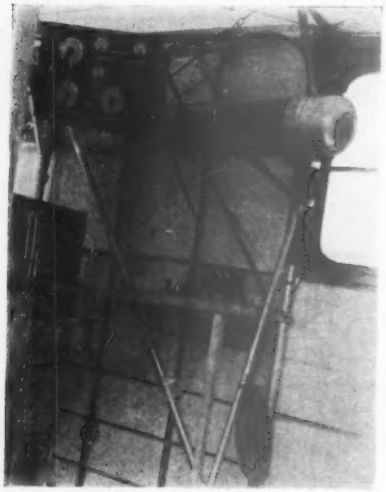
* * *

Advertising and broadcasting have enlisted the possibilities of aviation

(*Continued on page* 124)

German radio outfit for airplanes, shown at radio exhibit in Berlin.

Inside installation of radio equipment on Roma, showing retractable generator folded back.



National Air Races

(*Continued from page* 15)

There were five national conventions held during the week in connection with the races and exposition.

The National Aeronautical Association held sessions on three days at the Ambassador Hotel and elected Hiram Bingham, United States Senator from Connecticut, president, to succeed Porter Adams, who held the office two years and declined a third term and was elected governor-at-large. General Mason W. Patrick, former chief of the Army Air Service, who was prominently mentioned, refused to allow his name to be considered.

Roscoe Vaughn of Wichita, Kan., was named vice-president; Valentine Gebhart of Seattle and B. F. Castle were re-elected secretary and treasurer.

The Commercial Airplane Manufacturers' Section of the Aeronautical Chamber of Commerce of America held its third national meeting on two days in the Exposition Building.

The Society of Automotive Engineers held sessions on September 11 and 12 at the Biltmore Hotel.

Correction

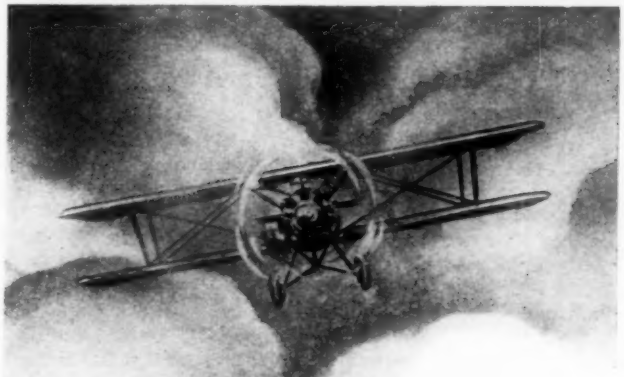
In the October issue of POPULAR AVIATION, Line of Position, and Star Altitude of Curves, publications of the Weems System of Navigation, were listed at $1.75 apiece. POPULAR AVIATION wishes to make both an apology and a correction. The present edition of Line of Position sells for $2.50, and the next edition will probably sell for $4.00. Star Altitude Curves sells at $5.00 per band of ten degrees of latitude.

Cradle of Aviation

(*Continued from page* 81)

flanked by water and woodland. Scientists hie hither to search for the marvels of flora and fauna concealed amid the thickets. And in uncounted myriads the masses from Chicago, Gary, Indianapolis, have come to play and refresh themselves in this wonderland where Nature has been so lavish of her charms.

In 1896, however, the Miller sand dunes bore another reputation. They were something to be shunned, especially at night, unless there was plenty of company along. Old settlers in that secluded hamlet



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vividly recall some of the incidents that conspired to give this land its eerie associations.

There are memories of hordes of Chicago bar room hoodlums swarming from trains under cover of darkness and straggling in disordered array down Main street to the water's edge a mile away. From heights above some natural amphitheatre in the hills the wondering natives who dared to follow would witness weird sights. By the flickering light of huge driftwood bonfires they would see the pugilistic giants of the Chicago "bad lands" strip and square off for primitive struggle such as only men of the mauve decade could fight in wild, open spaces where neither the sheriff nor the Marquis of Queensberry was known or respected.

Sometimes results would not be what half the crowd thought they should be and after the attendant free-for-all, knock-down-and-drag-out fracas, villagers would be numerously impressed as stretcher bearers to help incapacitated weaklings back to the station.

Sometimes it was only a cock fight which disturbed this happy hunting ground, but once, ah, once—and the old settlers still shudder when they tell it—once they cremated a man right there at the foot of Chanute Hill.

That story belongs to the annals of the old Whitechapel Club, an organization of Chicago newspaper men, and concerns the efforts of that esoteric society to fulfill the dying wish of a brother that his body be burned with pagan rites on a funeral pyre under the open sky at midnight.

There seemed to be no other place but this No Man's Land of the dune country in which the thing was possible. So in Miller today you will find old folks who still discuss "the cremation they had down there once."

Thus it happened that when Chanute appeared in Miller and hired a dray to haul his apparatus into the dunes the villagers decided the matter was worth watching. Chanute has written simply: "We soon had more visitors than were altogether pleasant in our preliminary experiments."

By chance the writer discovered a villager who still preserves vivid memories of Chanute's "queer capers" and here for the first time in print are presented some side line impressions from one who "peeked."

"We all thought Chanute was just plain crazy," says William Westergren of Miller, now a man of sixty and a member of the Gary, Ind., police force.

In 1896 Westergren was "railroading" and being at home on a lay-over he with a companion now dead, decided to find out just what Chanute was up to.

"We used to creep up the hill and hide in the bushes where we could look down on his camp," Mr. Westergren told me. "Chanute, as I recall, was a little short man, grey-haired and with a beard, who was always bustling around, looking after everything. He never did any flying himself but would stand, watch in hand, to time the duration of the hops his men made with their gliders and then help to measure the distance covered.

"Chanute acted so odd we were afraid of him and didn't dare show ourselves when he was close by. But when he walked off anywhere we would sneak out to look at his machines and talk with the other fellows who told us what he was doing."

The wings of Chanute's first glider, according to Westergren, were made of chicken feathers. I have found no mention of this in any of the engineer's papers and the statement is offered as something new. On the frame work of the wings of the glider, Westergren explains, was stretched a net-work of wires to which rooster feathers were fastened, overlapping as wing feathers do and forming a firm, thatched surface.

Chanute did not use this feathered glider much, Mr. Westergren says, and after it was damaged in a fall he made another on which muslin coated with varnish was used in place of the feathers. Westergren is somewhat vague in his recollections of the forms of Chanute's various machines. He remembers, however, that for braces piano wire was employed and that this wire could be tightened by turn buckles.

"After each flight," he related, "Chanute would go over the glider, very carefully snapping his finger against those piano wire braces. Then he would put his ear down to catch the tone of the vibration. If it was not the right pitch he would manipulate the turn buckles until he seemed satisfied that everything was proper."

In his mind's eye he can still see the gray-haired old engineer "tuning

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up" his gliders by twanging the piano wire braces and twisting the turn buckles and his demonstration today is probably historically accurate. Certainly in 1896 the reports carried back to Miller must have confirmed the village opinion that "a crazy man was down in the dunes trying to fly like birds."

"It all surely looked crazy to us in those days," Westergren sums it up.

Chanute, of course, tells another story. Before the secret of flying could be solved, he said, in a paper read later before the Western Society of Engineers, ten problems required consideration and of the ten he placed first in importance the problem of how to maintain equilibrium.

"I reached the conclusion," he says, "that until automatic stability at all angles of flight and condition of wind was evolved and safety thereby secured, it would be premature to seek to apply a motor or a propelling instrument in a full-sized machine, as this addition would introduce complications which might be avoided at the beginning."

For seven days the enthusiasts practiced with a glider made on Lilienthal's bat-wing model. Discarding this, another, designed by Chanute himself, was taken up. This at first had six pairs of wings superposed one above the other and pivoted to a central frame. Later one pair of wings was removed and the curious device has become well known through pictures as Chanute's multiple plane glider.

It was the writer's good fortune to be present not long ago when the original models of this odd machine and three others were discovered in a dusty packing case in the attic of the Chicago Academy of Sciences where Chanute's heirs had placed them following his death in November, 1910, and where they had been forgotten and undisturbed until removed to be photographed.

Incidentally Director A. M. Bailey of the Academy promises that the precious relics will be kept until the Rosenwald Industrial Museum is erected in Chicago under plans now being perfected. Visitors to that new institution of the near future will then be able to see these tiny priceless objects made by the great experimenter for theoretical study in his library and to guide him in constructing the finished gliders used that summer in the dunes.

Five types of gliders were tried out in the sand hills and at last Chanute settled on the biplane as the form which most nearly satisfied the requirements for securing "automatic stability at all angles of flight and conditions of wind."

It is not within the province of this article to discuss the subsequent development of Chanute's biplane from its birth in the Indiana sand dunes until today it is the common and familiar form of airship used the world around.

Percy S. Pilcher, an English aviation experimenter, writing to Chanute from London on January 23, 1898, says in a hitherto unpublished letter: "From the time you have taken all through I imagine you to be more desirous of having the general problem of flight solved than that you should have all the honor."

This off-hand expression from a contemporary and competing worker, several years before the Wright brothers actively began to study the art of flying perhaps best explains why Chanute's part in the development of the biplane has been overlooked by the world at large.

When Chanute died his heirs gathered up scores of letters full of technical discussions and mathematical calculations which he had written to the youthful Wright boys in Dayton. These letters, a Chicago friend has remarked "would indicate

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that his interest and his equity in the mechine-driven-biplane while not at all tainted with commercialism, were more than passing and casual."

Chanute, says still another, was "an idealist and more willing to give credit to others than to claim any himself."

It is not possible to follow here in detail the activities attendant on the birth of the biplane. Chanute declares more was learned concerning the practical requirements of flight in two weeks than he had gathered during many previous years of theoretical study and experimenting with models. Being an elderly man he made no flights himself that summer, but quaintly he remarks: "When a man is riding on a machine and his safety depends upon his observance of all the conditions he keenly heeds what is happening to him and he gets entirely new and more accurate conceptions of the character of the elements which he is seeking to master."

On July 4, the party returned to Chicago, but on August 20, sailed down the lake again (by boat) with three newly constructed machines. With them this time came a surgeon, Dr. Howard T. Ricketts, who had been hired to do the cooking and to set broken bones if necessary. This latter duty, fortunately, he was never obliged to perform.

Since the first camp near Miller had proven too public, another five miles down the coast was selected as more secluded. It appears to have been near the present location of Dunes Park. Experiments and tests which ensued here were eminently successful. One glide of 359 feet was made by Herring and on one trip a relative speed of 52 miles an hour was obtained. Records of the many other hops are equally impressive.

"It was very interesting," Chanute relates, "to see the aviator on the hillside adjust his machine and himself to the veering wind, then when poised take a few running steps forward, sometimes but one step and raising slightly the front of his apparatus, sail off at once, horizontally against the wind; to see him pass with steady motion and ample support forty or fifty feet above the observer and then having struck the zone of comparative calm produced by the eddies from the hill, gradually descend to land on the beach several hundred feet away."

Some of Chanute's conclusions regarding his summer's work are significant and worth recalling today in the light of subsequent developments.

"It is my judgment," he said, "that one or two more seasons should be devoted to perfecting the automatic equilibrium; to eliminating hidden defects and to adjusting the strength of the springs and moving parts before it will be prudent to apply a motor or to try to imitate the soaring of the birds."

And again about "pecuniary profit" he says: "I believe it to be still afar off, for it seems unlikely that a commercial machine will be perfected very soon. It will in my judgment be worked out by a process of evolution, one experimenter finding his way a certain distance into the labyrinth, the next penetrating further and so on until the very center is reached and success won."

And finally he says, so prophetically: "It is probably possible to evolve an apparatus with automatic stability in the wind, but in order to do so, there must be some moving parts apart from the man, in order to restore the balance as often as it is compromised."

For a brief moment I would like once more to stand on Chanute Hill near the Lake Michagan shore and again lifting the eyes to the airplane we saw soaring overhead, venture one last reflection on that pilot's intelligence. Probable, it is, he did not know that the air lane he followed clings closely to the old Chicago-Detroit post road, first trod by a

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white man 252 years ago and rich in history from that day to this.

Plans are afoot to erect near Chanute Hill a memorial to that ancient traveller, the Jesuit Father Jacques Marquette. As for Chanute Hill, the very memory of its bulky presence seems destined soon to fade like the shadows at the end of day. Throughout last summer a fleet of unromantic but industrious caterpiller tractors toiled and tugged up and down, striving with scoop shovels to level the historic mound. Soon it will be transformed into "choice residential and business sites" as the bill boards of the subdividers proclaim and all trace of Chanute Hill will vanish.

Nothing will be left to recall that here America's infant aviation efforts first caught the stride which sent the early dreamers on to victory in their campaign for conquest of the air. When Marquette's memorial is unveiled why cannot another rise beside it, dedicated to Octave Chanute, "the father of American aviation," here in the spot where he gained his glory?

Formation of Ice

(*Continued from page* 42)

a lesser increase in drag, if any at all. As a matter of fact, it is possible to conceive an improvement of the aerodynamic shapes due to this deposition. The conditions are found and the consequences are the same whether upon struts or wires, or upon wings.

A number of means of prevention or removal of this ice formation have been suggested and many have been tried, although the results of such trial are far from completion. These include methods of heating the affected parts, the oiling or greasing of the parts to reduce the tendency of the ice to adhere to the surfaces and the impregnation of this oil or grease with a chemical which would unite with the water to form a solution having a lower freezing point.

The oiling or greasing of the wings being the most simple expedient, has been most frequently tried and its efficacy does not appear from the history of its trial to be of any value. As a matter of fact, evidence is found of opinions that it hastened the formation of the ice. An explanation of this phenomenon may be found in that, while a greased or oiled surface would normally shed water, under the condition of flight through rain or fog, the surfaces are bombarded with particles or drops of water at a velocity equiva-

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lent to the flight speed of the airplane, which is sufficient momentarily to embed the drop of water in the oily surfaces, where it is held for the small period of time necessary for it to freeze. Ice then may continue to form on this film of ice until eventually the oil is completely covered with a film which may be anchored either to the oil or by the force of the bombardment to the surfaces beneath the oil. The method cannot be considered seriously in view of reported evidence and experimental information in which ice has been observed in a thick coat over a large area of oil on the fuselage which was provided accidentally by leakage from the engine.

The addition of a chemical to the oil or grease may be of merit. It has the obvious disadvantage, however, of being "messy" and might possibly be to a great extent removed by the scrubbing action of the high velocity "rain" if maintained for any length of time.

The method of heating the surfaces appears possible by piping the exhaust through the leading edges of the wing. This method apparently has promise only in the case of a cantilever monoplane or of such other structure having a minimum of exposed structural parts. It would be necessarily impossible to apply such a method to an airplane similar to a DH-4 on account of the large amount of struts, wires, etc. Suggestion has been made that only a slight amount of heat applied to the leading edge of the wing might be sufficient to prevent ice formation, and this is probably true, although it may be attended by only a change in the amount and character of the formation, that is, if the leading edge were heated and the balance of the wing was not, it might only prevent the formation along the leading edge and cause this formation to build up along the chord at other points and particularly at the trailing edge where the aerodynamic malformation might possibly be only slightly less disadvantageous.

In conclusion, it is evident that when these conditions must be encompassed, that if it is possible to rise to a higher, colder altitude they may be avoided almost equally as well as descending to a lower and warmer altitude. This alternative avoidance has the obvious disadvantage that it will not be effective after the formation of ice has progressed to any degree; perhaps even if it has begun at all, but it has the greater advantage in that higher and colder altitudes are always available, whereas lower and warmer altitudes might not exist, as in the case where the ground temperature is below 32 deg. F.

The recommendation for the guidance of those who must encounter these conditions appears to lie entirely along the lines of their avoidance. For the information of the pilot, a temperature thermometer of a distance type should be installed in all airplanes indicating from a remote "bulb" on a strut or wing of the airplane the temperature of the surrounding atmosphere. He may then be guided to avoid the combination of conditions which produce the greater hazard as has been outlined.

A Forced Landing

(*Continued from page 64*)

modore of the Yacht Club had blown back and jammed the wind pump that pumped the gas from the main tank in the fuselage to the gravity tank over head. We got out our trusty hose again and siphoned some gas from the main tank and put it into the gravity tank and taxied out into the main channel and were soon in the air again.

Popular Aviation awards a fine $100 wrist watch each month for the best story of a Forced Landing, giving names, dates and places. Photographs are desired if it is possible to furnish them. They will be returned if so ordered. Address "Left Wing Low," Popular Aviation, 608 So. Dearborn St., Chicago.

Everything went fine at Hudson as we made a perfect landing and take off. I had particularly instructed Hughes to land at Albany between the two Hudson River bridges which are about two thousand feet apart, as we were to be met at the Municipal Pier between the bridges on the Albany side by a reception committee from the Chamber of Commerce. As we approached the first bridge we were flying at about five hundred feet altitude. Suddenly Hughes nosed the plane sharply downward. I shook my head and motioned to him to land above the bridge but he paid no attention to me. In another instant he yelled to me to hold on tight. Our motor had quit us again and we were coming down fast and straight at the bridge with a dead stick. Across the river on the Rensselaer side they were having a baseball game and a large part of the crowd had rushed to the beach to witness our landing. The bridge was coming up at us fast. Our angle of descent was decidedly uncomfortable, as we were seated in an open cockpit and not strapped in. I realized that Hughes was trying to duck under the structure as he had no warning nor time in which to side slip away from it. We missed the bottom of the bridge by inches and hit the water so hard it nearly knocked the breath out of me. However, it seemed to please the crowd on the beach.

It was not the fault of the wind pump this time. We were entirely out of gas. The plane had been serviced with more than sufficient gasoline for the trip at the hangar, but evidently we had unloaded more than we realized in making the plane light enough for the first take off. As the launch towed us up to the Municipal Pier, our ship was leaking badly.

After a hurried greeting to the committee from the Chamber of Commerce, I jumped into a waiting automobile and was driven to Al Smith's house, the Executive Mansion, with the package containing his wife's new dress and part of our gasoline, the traces of which by that time had somewhat disappeared. The colored butler who met me at the door said "Lordy, Boss, I'se been expectin' you but was afraid you might not make it. I guess this aeroplaning will be a great business some day. Mrs. Smith sure will be glad to get her dress."

I didn't wait to find out and for several days thereafter was expecting to hear reports of a big shake up in Albany in case one of Al's famous cigars came too close to our gasoline supply, stored in his wife's dress.

Financing Flying Clubs

(*Continued from page 76*)

is retained, but if repairs are made by the field personnel, fixed repair cost can be estimated at about the same price. Where more than one aeroplane is used it is generally cheaper to retain a mechanic. To be safe, a fund for contingencies of $1,673 or 10 per cent of the total of the previous items should be allowed. In other words, total yearly fixed costs will amount to $18,404.93. Therefore the yearly dues should be fixed at $368 per member, or, to make a round figure, $370 per member.

Flying cost per hour is estimated at $8.53 per plane. I will point out how this figure is arrived at in subsequent paragraphs. This figure will change if an instructor is retained on a yearly basis, in which case the pilot guarantee item can be removed. It will be found, however, that most pilots, especially the first year, would prefer to be on a salary basis.

Let us assume that a student goes to a public flying school, pays $25 an hour for dual instruction or $20 an hour for solo flying, which are the minimum rates made at public fields. Let us say that he requires ten hours dual instruction before soloing, and that, during the remainder of the year, he accomplishes 50 solo hours of practice. He will therefore spend $1,250 for sixty hours of flying. Sixty hours is about the minimum number per year which the flying enthusiast is willing to fly. This averages a little over one hour a week. If he is a member of a flying club, such as the one described above, he will pay the first year $645 in initiation fees and dues, and $600 or less for his sixty hours of flying, or $1,245. Therefore, the student will not gain much the first year by joining a proper flying club. However, in subsequent years, he will save at least $300 and probably more, because at $10 an hour, and with dues set over the actual fixed costs, the club should pay dividends. There will be no assessment for new equipment inasmuch as the figures cover depreciation on equipment.

It can readily be seen that a flying club is therefore a paying investment for anybody who intends to do serious flying, but does not pay for anybody who plans to do less than 45 hours per year. Clubs which are not organized properly may be cheap for the first year, but they are infinitely more expensive later.

It might interest the reader to see how engineers estimate the comparative running costs of OX 5 motors and modern motors of from 125 to 135 h.p. inasmuch as flying clubs are today depending on the OX 5.

Gasoline, oil and grease for the OX 5 motor costs approximately $3 an hour and approximately $3 an hour for the modern 125 or 135 h.p. engine. Engine depreciation is figured at $2 per hour for both motors (the OX 5 has a 500 hour life and costs about $1,000 while the other motor has 1,500 hours life and costs $2,970). Allowance for crash losses not covered by insurance is figured at $1.50 for the OX 5 and $1.75 for the modern motor.

Engine overhaul for the OX 5 is $2 per hour, and for the modern motor $1 per hour. The OX 5 is overhauled every 100 hours at a cost of $200, whereas the 125 to 135 h.p. engine is overhauled every 250 hours or more at a cost of $250.

Contingencies at 10 per cent will be 85 cents per hour for the OX 5 motor, and 78 cents an hour for the modern motor, making a total running cost per hour for the OX 5 of $9.35 and $8.53 for the modern motor.

These figures may be, in fact are, unquestionably rather dull reading but they are the result of years of research and experience in cost figuring, and it has been found by experience that estimates compiled in this way are accurate. It therefore behooves the flying enthusiast to take as much care in examining any flying club proposition as he would in investing his life savings. He not only faces financial loss in the improperly organized flying club, but he faces actual personal danger, inasmuch as lack of funds or a sloppy organization will ultimately be felt by the equipment itself, by morale, and serious accidents will result from these conditions.

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Our Library and Yours

(*Continued from page 99*)

navigation. The air speed indicator, the altimeter, the course and drift indicator, and finally, the Pioneer Earth Inductor Compass, are all treated. Pioneer Bank and Turn Indicators, and Pioneer Altimeters are also carefully described. There is a chapter on magnetic variation and deviation, and rather full instruction in navigation, illustrated by test problems with diagrams. Sections on radio directional service are of interest, as well as sections on Long Distance Flying, and Night Flying and Night Flying Equipment. An interesting chapter on Ice Accumulation on Airplanes is a feature.

The meteorological section is concise and practical. Wind, clouds, and fog are discussed. The chief merit of this book lies in its compact, intelligent, and attractive presentation of a very vital phase of aerodynamics. It is a well wrought textbook and should certainly commend itself to aviation students.

HISTORIC AIRSHIPS, by Rupert Sargent Holland, illustrated by Manning de V. Lee. Macrae Smith Company, Philadelphia: 1928, 343 pp. $4.00.

This book is a well-written, well-illustrated and well-printed summary of the history of flying, from the time of Icarus's famous crash to the present day. Flying, in its broadest sense, includes every sort of attempt made by man to lift himself from the ground. Not the least daring and picturesque among aviators were the Montgolfier brothers and Professor Charles. In 1783, Joseph and Etienne Montgolfier succeeded in sending aloft a sheep, a cock, and a duck in the basket of a fire-balloon. The three passengers ascended to a height of about 1,500 feet, and stayed in the air eight minutes, landing unharmed some two miles from the starting place. Shortly after this experiment Francois Pilatre des Roziers and the Marquis d'Arlandes flew over Paris in a similar Montgolfier balloon. This was the first "free" flight of human beings in history. Investigations with hydrogen balloons followed rapidly, after Prof. Charles' initial effort, and culminated at last in the development of large drift balloons which were used for communication to and from Paris during the War of 1870. A little more than twenty years later Santos Dumont began experimenting with a dirigible balloon, equipped with a small motor. After a series of vastly exciting trials, which more than once left him deposited in the branches of trees or on the roofs of indignant maisons, Santos Dumont succeeded in wobbling his sixth dirigible from the Aero Club Park around the Eiffel Tower and back in thirty minutes, thus winning Henri Deutsch's prize of 100,000 francs.

Conjointly with the development of propeller-driven dirigibles, gliders were being built and tested. Cayley, many years before, had discovered the elemental facts of aerodynamics, and other investigators, following his lead, had been more or less successful. Langley, though unfortunate in operating his invention, succeeded in constructing an airplane that had most qualifications for flight. Lilienthal, Chanute, Herring, Ader, and Maxim all built fairly airworthy craft, and finally Wilbur and Orville Wright flew the first plane.

Mr. Holland's book is a kind of memorial to the adventurers, the scientists, the dreamers, and the martyrs whose efforts finally shook men loose from the earth. It is a readable history of the development of aviation, and a convenient reference work for more recent flying triumphs. In the latter half of the book war aviation is discussed, and the worldwide flying of post war days is very adequately reported. As a single volume account of men and deeds in aviation, from Daedalus to de Pinedo, this book is almost unique.

Ways of the Winds

(*Continued from page 22*)

are. Was the commanding officer's judgment good when he decided to pass over the storm? He could have turned tail and have flown safely ahead of it with three times the velocity necessary to keep out of the way.

The tornado is the smallest and most terrific of all storms. It is seldom over a mile in width at the earth and it travels leisurely at about twenty miles per hour. Its black funnel strikes terror into the hearts of all who see it coming over yonder hill. But even a horse can travel fast enough to dodge it if given a fair start, for it is only necessary to get to the westward of it. It never travels westerly.

On the other hand, the hurricane is of great width—sometimes a hundred miles. It often travels at nearly 100 miles per hour. Although its velocity is great, the barometer tells of its approach many hours ahead and, with meteorological stations widespread as they are, people are now warned a day ahead. The hurricanes which visit Florida and the West Indies are born down in the Caribbean Sea. They sweep northward, spreading havoc over the islands of the archipelago and turning toward Florida or curving again northward, dissipate their energy along the Atlantic coast or out at sea.

With an understanding of these general causes and effects and of cloud-signs, the reader has a good beginning toward a practical knowledge of the ways of the winds. But after learning these fundamentals, nothing can do as much for him as observation of winds and weather. Note a thunderstorm approach. The wind has been westerly and the sky is blue. The day is hot and humid—perfect for a thunderstorm. Perhaps there is a faint roll of thunder from the west. The westerly breeze dies down and a gentle easterly comes to life. The upward currents of the thunderstorm bring air from all directions to replace the lowered pressure. Soon the breeze freshens and then calm reigns. This is ominous, foreboding, for the black clouds are near at hand. A long cloud rolls along in advance of the thunderhead. This is the squall cloud. Its rolling tells the observer the ways of its winds. The trees bend and the dust flies. The squall cloud is near. Huge drops have begun to fall. Soon there is thunder, lightning, rain and perhaps hail.

Above, at three or four miles, blue sky canopies this mighty thundermountain. Sometimes its boiling crest extends five miles. The windwise flyer knows these boiling crests are due to strong upward currents and that there are also weaker downward currents. He may fly close but, knowing the ways of the winds, he is cautious. No invisible current will catch him unawares. Below, the storm is becoming less violent. The sky is lighter in the west. The rain is steadier—less gusty. It is now drizzling. This stops. The sun shines and the blue sky appears. A rainbow is seen in the east. Nature's great sprinkler, born of and borne by the winds, is wetting the thirsty landscape to the east. To the wise flyer this is an incident which knowl-

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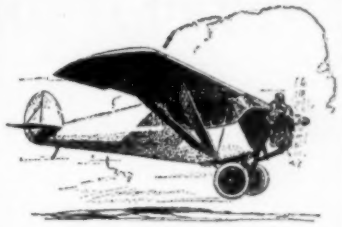
The cyclonic storm is heralded by cirrus clouds far in advance of the storm. The winds blow toward its center, which may be hundreds of miles in diameter. As this storm approaches the wind becomes easterly—blowing in general toward the west, from which the storm approaches in most of the United States. If the storm-center passes to the north of the observer the winds change to southeasterly and then to southerly. As the low passes to the north, the wind changes to southwesterly and as the sky clears there is a gusty period and then deep blue sky and a westerly breeze tells the observer that the storm is over. This sequence may take a day or so.

Sit on the shore of a lake or of an ocean on a hot summer day. Watch the clouds come floating lazily from over the water. As they come vertically over the hot sandy beach or hot dry earth, see them torn more or less violently upward. The heated air from the land becomes lighter and it rises at a velocity of four to six miles per hour. The unsuspecting cloud, floating gently in the horizontal sea breeze, strikes this updraft and the observer has learned something more of the ways of the winds. Knowledge and observation tell the flyer that here is a bump awaiting him.

So it is on a clear summer day when cumulus clouds are forming, due to the vertical currents of heated air rising from the earth. Here, too, are bumps—not startling, but they prepare one for more serious ones caused by updrafts. Even a huge chimney which belches smoke and hot air from a factory provides a bump of the same kind.

Over a hot, barren desert there may be no clouds, but knowledge, gained through observations combined with an understanding of general causes and effects, warn one that this region will be bumpy. Over such a hot area in the day time it is bound to be bumpy. Swift upward currents of heated air are not made visible by clouds, because there is not enough water-vapor in the air to form clouds by expansion. Nevertheless, the vertical currents are present and the flying is bumpy.

And then watch the take-offs on a windy day. Note how the hangars and other obstacles deflect the dust-laden air. Near the earth the flying is bumpy and this is not the best day for the novice to begin his first—or second—solo flight.



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Aviation Training

By Donald E. Kehoe

(*Continued from page 62*)

is entitled to this additional free flying time in the succeeding month or months. Both nonresident members and nonresident associate members can take advantage of their free flying time at the city and at such other times as the club ship may be on an official cross-country visit to cities where nonresident and nonresident associate members reside. Extra flying hours for members and associates at the airport will be charged at the standard club rate of $5 per hour. Nonresident members and nonresident associate members will have the same privilege when the ship is on an official cross-country trip to cities where the nonresident members and associates reside. Each member will be expected to carry associate members when flying their free time and the amount over and above the standard club rate of $5 per hour will be credited to the sinking fund for amortization, insurance, interest charges, and extraordinary maintenance.

The members have the privilege of using the ship commercially (passenger carrying) at the city airport at the standard club rate of $15 per hour whereby the pilot will be reimbursed for his services at the rate of $5 per hour; the club will receive $5 for the ordinary operating cost per hour of the ship; and $5 profit to be added to the sinking fund for amortization, interest charges, insurance, and extraordinary maintenance.

Members and associate members have the privilege with the approval of the field manager, of using the ship for cross-country trips at the standard commercial rate of $15 per hour, the revenue to be disposed of as above mentioned. The ship can be used commercially by nonmembers at the standard commercial rate of $15 per hour, plus the personal expenses of the pilot while away from headquarters, plus 50 cents per daylight hour stand-by time for the first day; $1 per daylight hour stand-by time for the second day; $2 per daylight hour stand-by time for the third day, etc.

The medical profession has preference right to the emergency use of the ship at all times.

Members and associates will be required to pass a physical examination made by official club flight surgeons.

Insurance provision for both plane and personnel of the club will be provided for in some manner. At present it is known that insurance can be obtained on the plane at a fairly reasonable rate, and it is believed that group insurance can be obtained for the personnel of the club.

Members will not be held liable for any accidental damage resulting to the ship or to property damages, as this will be taken care of by insurance provision. Pilots and passengers will be personally responsible to themselves and to no others. The club will not be responsible for personal damage to occupants of the club ship except as may be provided for by group insurance provisions.

Members and associates must receive approval of the field manager for any proposed flights and must properly fill out the card of the ship's log and such other information as may be included thereon.

The club will be duly incorporated and run in an efficient businesslike manner and will be self-sustaining. Memberships will be nonassessable until authorized by at least two-thirds of the entire club members.

Articles of incorporation, the constitution and by-laws, and such other preliminary business as may be necessary will be disposed of by the executive committee.

Estimated monthly revenue and expense for first 6 months:

Monthly income from membership dues:	
20 members at $5	$100.00
125 associate members at $2	250.00
10 nonresident members at $2.50	25.00
30 nonresident associate members at $1	30.00
Total revenue from dues	$405.00
Estimated net revenue from commercial operation of ships	50.00
Total revenue per month	$455.00
Estimated free flying time, 50 hours monthly.	
Actual cost of free flying time, at $4 per hour	$200.00

NOTE.—Includes 50 cents per hour overhead but not the item $71 for interest, insurance, extraordinary maintenance, and amortization.

Operating expense per month	$200.00
Net revenue to sinking fund	$255.00
From reserve to balance sinking fund charge	16.50
Sinking fund, monthly for first 6 months	$271.50

NOTE.—By the same calculation, succeeding six months' periods should show a profit as follows:

Second 6 months: Net revenue $255, sinking fund charge $150.75= $104.25 profit to reserve.

Third 6 months: Net revenue $255, sinking fund charge $100.75= $154.25 profit to reserve.

Fourth 6 months: Net revenue $255, sinking fund charge $75=$100 profit to reserve.

Other source of revenue: Club parties, dances, rental of club for private parties, club store, etc.

Should old members fail to pay dues or drop out, new members will be taken to fill their places.

Resident associate memberships will be limited to 125 until such time as more members become available to serve as pilots to fly free flying time.

The department has received inquiries from younger boys in regard to the best course to follow in entering aviation or in acquiring a general knowledge which will be useful later in taking up actual flying.

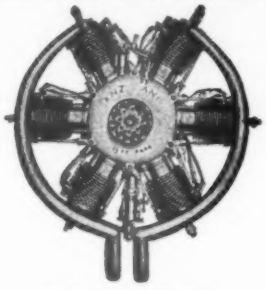
A general study of aeronautical books and bulletins will give a fair picture of the aviation industry. The department's Aeronautics Bulletin No. 6 contains a list of Government and private publications which should be useful.

Model airplane clubs have already proved their value. High schools are now establishing aviation courses on account of the insistent demand for this instruction by their students. This is good background for later development. It is possible that some students will be able to spend their vacations or a part of them at airports or other bases of flying activities watching operations and perhaps even performing minor services at the airports in order to obtain general knowledge.

Such experience will be invaluable if the prospective student of aviation later enters a university with an aeronautical course or even if he enters a regular commercial school for flight training.

The following extract from a bulletin of the Daniel Guggenheim Fund for the Promotion of Aeronautics (Inc.), a nonprofit-making organization, is quoted as of probable interest to those seeking to enter

FOR THE SMALL PLANE



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the aviation industry. It represents the opinion of important men in aviation, including Col. Charles A. Lindbergh, F. Trubee Davison, Assistant Secretary of War for Aviation, Harry F. Guggenheim, Dwight Morrow, and other members of the Daniel Guggenheim Fund.

The Opportunities for Trained Mechanics and Pilots in Commercial Aviation

Information covering the qualifications and demand for pilots, ground engineers, and mechanics was furnished by eight large air transport companies. Forty-three prominent aircraft manufacturers gave data relative to the requisite training and to the possibility of vacancies in their organizations toward the end of the college year.

The Need for Aeronautical Engineers

Practically all the aircraft manufacturers, except in three instances, employ graduate engineers in their engineering departments. The number employed ranged from a single graduate in the smaller companies to as many as 51 in a very large company, the average number being 4. But while a technical education was deemed essential, less than 17 per cent of the graduate engineers employed had pursued specialized courses that led to a degree in aeronautical engineering.

Forty-three per cent of the manufacturers stated that they employed graduate engineers in executive positions, but in only 5 companies were the executives graduates in aeronautics. Yet the demand for young men with a highly specialized training is apparent, judging from answers given to the question, "When employing additional personnel, do you prefer graduates in aeronautics?" All but 10 manufacturers answered in the affirmative. Of these 10, 5 stated only practical experience was necessary, 4 gave a negative answer, and 1 manufacturer declared his preference for graduates in mechanical engineering.

Aeronautical graduates are especially needed in engineering departments where a knowledge of draftsmanship and structure is considered desirable. For positions such as shop foremen, previous aircraft manufacturing experience is the most important requisite, but for the higher positions involving a thorough knowledge of design, stress analysis, etc., a specialized education is a necessary qualification.

Graduates in aeronautics are not as a rule seeking jobs. Fifty per cent of the manufacturers reported that aeronautical graduates had not

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applied to them for positions on their staffs. The others said they did receive a few applications, but rarely more than one or two in a month.

Opportunities in Aircraft Manufacturing

Conditions in the aircraft industry, which is undergoing a process of wide expansion, offer good opportunities to young men with the necessary qualifications. Twenty-four companies expressed themselves as being likely to employ graduates in aeronautics toward the end of the college year. Two manufacturers will have positions for at least eight men, four manufacturers believed they might employ three men, three companies said they would be likely to need three men each and the others wanted one or two new men. The changing conditions in the aircraft industry at the present time left seven manufacturers in doubt as to how many men they would be likely to need some months in advance. Only eight manufacturers stated they would have no vacancies in the immediate future.

Pilots—Education and Training

"What is the character of the general education of the pilots in your employ?" air transport companies were asked. Eight replied that most of their pilots were high school and college graduates who had had aeronautical training. When these pilots were employed, they already had an average of more than 1,000 hours of flying to their credit. Five hundred hours of flying time is the minimum required of new pilots by air transport companies. These employ an average of 3 pilots, though one company has as many as 29 pilots on its payroll.

Most pilots received their training in the Regular Army or Navy or in the reserve corps. A few pilots gained their experience in the commercial field after a solo flight. The most desirable experience for their pilots, as the air transport companies see it, is a combination of Army and commercial training. Barnstorming, night and cross-country flying in bad weather afford desirable experience to student pilots.

Flying Schools Must Increase Equipment

In answer to the question: "What could private flying schools do to give you pilots with better training?" the opinion was generally expressed that these schools, as at present constituted, could do very little. It was pointed out that they lack the equipment or necessary personnel to give as good instruction as is afforded in the Army and Navy schools, or even in commercial flying such as "barnstorming." The private schools did not give sufficient cross-country experience in various type of planes. One company suggested that a private school might be helpful in giving instruction in air navigation; another proposed greater emphasis on "blind" flying. It was also stated that undoubtedly the expansion of aviation in the future would result not only in better flying schools but in a greater need for their services.

The number of new pilots that may be needed depends on the development of commercial air transportation. Only two companies were able to hazard any guess, one stating that it might have vacancies for two men this season, and another said that it would be able to employ two or more per month. At the present time the Army and Navy appear to be able to fill all needs. "The main objection to flying school graduates," one company wrote, "is the limited scope of their experience. The air services seem to offer the only opportunity to acquire sufficient cross-country experience on various types of planes. On the other hand the so-called 'barnstorming' commercial pilots make good material."

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Qualifications for Ground Engineers and Mechanics

Positions as ground engineers and mechanics are open to a wider field of applicants. In the first place, the number employed is much greater than the number of pilots. Taking the reports of the eight air transport companies, the smallest number of ground mechanics employed by a single company was 2 and the largest number was 104; the average number was 26.

The general education of these men includes high-school training, and in some instances they are graduates of a college or technical school. High-school training seems to be the minimum educational qualification. Their mechanical experience covers general and special aviation shopwork in addition to field aviation experience. They are all licensed by the Department of Commerce except those who are helpers.

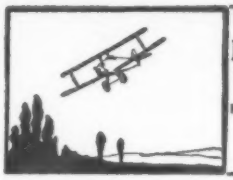
The majority of the ground engineers and mechanics now employed by air transport companies have obtained their special training in Army and Navy schools. About 30 per cent of the remainder entered the employ of manufacturers and gained experience there, but the number of those men who trained in flying schools was less than 20 per cent.

Shortage of Trained Men

There is a shortage of trained men for positions as mechanics and ground engineers, but it is doubtful whether or not private flying and mechanic schools can furnish the necessary training; because, up to the present time, most of these schools have not been developed to the point where they are equipped to meet the standards set by air transport companies.

Applicants are preferred who are aeronautically trained mechanics or who have had experience as airplane factory mechanics. Men are also considered for positions who have been trained as automobile mechanics or in trade schools. Training in a trade school, if thorough, is considered very desirable.

(This article of Mr. Kehoe contains much information that is being constantly sought by men desirous of entering aviation. A careful reading of the article, with particular reference to the statements about the training offered by the Army, Navy and Marine Corps, will save many of our readers a lot of unnecessary correspondence.)



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Central American Aviation

(Continued from page 36)

game for Guatemalans only. Foreign pilots who have attempted to start aviation enterprises there have failed because of the fact that they have disregarded several factors that make Guatemala a difficult country over which to fly. United States flyers generally find above an altitude of 5,000 feet the atmosphere is very calm. In Guatemala this is not true. There a pilot has to climb as high as 13,000 or 14,000 feet before he encounters a calm atmosphere. The prevailing winds move from east to west after the plane leaves the influence of the severe currents created by the abnormal configuration of the ground. It is peculiar, also, as a side light, that the valleys are clear when the mountains are cloud-covered, and the mountains are clear when clouds fill the valleys.

Aside from this particular mail and passenger enterprise, aviation in the other four Central American countries—El Salvador, Honduras, Nicaragua and Costa Rica—has made approximately the same progress as that of Guatemala. Many of the government flyers of the five republics have received training in the United States. Col. Granados was trained at Calstrom field, Arcadia, Florida, and at Post field, Fort Sill, Oklahoma. Lieut. Col. Diaz received his training at Curtiss field, Mexico City. He was a member of the late Capt. Emilio Carranza's class.

From a business point of view, the adoption of American planes by the Guatemalan government is significant to American manufacturers and distributors. As was pointed out in Mr. Zuniga's article which appeared in the June POPULAR AVIATION, American airplanes are better than European planes and, while higher in price, proper approach to Central Americans will convince them of the advantages of their use. The United States is the logical source of supply for the Central American countries. Central and South America should offer increasingly fertile fields for American aircraft manufacturers.

Now is the time to capitalize Col. Lindbergh's Central American flight in a material way. Some of the American manufacturers are awake to the possibilities. We believe that, "as Guatemala goes, so will go Central America." And apparently for civil purposes, Guatemala is permanently wedded to American planes.

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Aircraft Operation Laws

(*Continued from page 34*)

lation which will solve the individual state's problem.

Pennsylvania has gone into the "regular business" in more detail and with more thoroughness than any other state. General Rules and Regulations, published this year, cover twelve subjects, beginning with authority for rules and ending with a miscellaneous collection. They cover definitions of terms, licensing of aircraft, marking of both licensed and unlicensed aircraft, inspection, operation, licensing of pilots and student fliers, licensing of mechanics, air traffic rules, licensing of airports and landing fields and practice and procedure.

Each state in its Act has exempted for a brief period any visiting aircraft. Yet the provisions of any given state may prove different than those of the state from which the visiting plane comes. It is to avoid this situation that the uniform state law is designed and which it is hoped by those sponsoring it it will overcome.

(In future articles POPULAR AVIATION will present various other angles of the legal situation with particular reference to the operation of aircraft. We particularly invite inquiries from aircraft operators on the problems that arise in this connection and desire to offer the aid of POPULAR AVIATION in securing uniform legislation that is equitable to all.)

Belgium in the Air

(*Continued from page 31*)

The planes used on the passenger services are all Handley-Page trimotor planes built by the SABCA plant in Brussels. On several occasions these planes have proven invaluable in transporting the sick from outlying districts to the larger towns such as Leopoldville or Elisabethville where they were afforded proper treatment. During an outbreak of yellow fever sometime ago in Matadi many were able to make a quick escape by taking these planes to Boma. During this past summer the King and Queen of the Belgians used one of these planes between Boma and Thysville during a visit to the Congo.

The Belgians are devoting much study and effort towards eventually developing a system of connecting airways between Brussels and the Belgian Congo and it is hoped that it will be possible to have such a service in operation by 1930. They are particularly interested in such a project as a means of speeding up the mails and delivering valuable freight and several expeditions have been sent to the Congo to survey in view of this. They are now considering three possible routes; by way of the African coast which is partially developed by the French already, by the Nile and by the Sahara where the British have been making similar studies towards the establishment of a liaison between Europe and the African colonies. As one knows air lines already are operating for the transportation of mails along the French possessions on the West African coast as far as Dakar.

The proposed air route from Brussels to the Congo by way of this coast would be as follows: Brussels-Paris-Perpignan - Alicante - Tangier-Casablanca and all of the African coast as far as Dakar. Then continuing to Kayes - Bamako - Ouaga Dougou - Bomouga - Kotonou - Douala and Leopoldville.

The route of the Nile would be: Brussels-Basle-Milan-Rome-Brindisi-Tobrouk-Cairo-Wadi Halfa-Khar-

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toum-Redjaf-Bangui-Irebu and Leopoldville.

The Route by way of the Sahara Desert would be: Brussels-Paris-Perpignan - Alicante - Oran - Colomb Bechar-Reggan-Gao-Niamey-Zinder-N'Guigrui-Fort Lamy-Fort Archambault-Bangru-Irebu and Leopoldville.

At many of the towns in Africa on these proposed routes there are already landing fields without any equipment or personnel which in time will be adequately equipped as plans for future airways materialize. In many cases they are merely fields which have been kept in passable condition so as to serve as emergency landing fields and are occasionally used by military planes. An advantage in the maintenance of air fields in Africa is the fact that black labor is both cheap and plentiful. The aeroplane is fast becoming a familiar sight to the African blacks and though planes may fly over country where the natives get down on their knees at its approach the white population is sufficiently large to warrant the development of a speedy intercourse with Europe. It will be of great value for the transportation of valuable freight and mails which ordinarily take a month or more to reach their destinations in the Congo from Europe.

Navy Pilot Charts

(*Continued from page* 18)

information is of such nature that it can be plotted simultaneously and thus be useful "as is" to the aviators of all countries. The standardization of these data will be a forward step toward that desired eventuality—an international weather map. Today there is no other issue of similar importance under the sun upon which the countries of the world are dependent than universal weather reporting.

For the benefit of European aviators who may in the future fly to the United States, our Navy has briefed its upper air charting program. It records the number of charts completed and contemplated. The variation of the compass over the Atlantic Ocean is also given as well as the locations of the various steamship lanes.

A case in point of the measurable value of the pilot chart to aerial navigators is had in the variations in wind direction at different altitudes off New Orleans. In the West Gulf of Mexico, practically no surface winds sweep from the Southwest quadrant but the southwesterly and westerly winds increase at 2,500 and 5,000 feet altitudes. At an elevation of 10,000 feet above the sea level, no winds are recorded in the Easterly quadrant while 36 per cent of the winds come from the Southwest. The value of such indicative information to an aviator is self-apparent.

The U. S. Navy does not consider its first year charts of the upper air as perfect productions by any means. These charts are pioneers developed without either traditions or precedents to steer by. They are the forefathers of improved charts to follow. Uncle Sam's international fame as a producer of masterly seafaring charts is sure to be duplicated in the eventual production of flying charts of similar superiority. This invaluable data is aiding in the education of birdmen around the world. The chart for any month is issued and distributed in season so that the aviators of all countries have the information at hand before that specified month ushers in its first day. The U. S. Navy plans in the course of time to issue accurate pilot charts of the upper air conditions above every ocean over which birdmen will fly.

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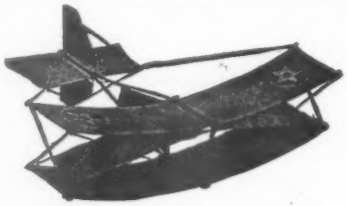

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(*Continued from page* 106)

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Special precautions must be taken against motor noises, and ignition noises, the one being distinct from the other in that the first is mechanical, and the other electrical.

This process of shouting remarks from the air must not be mistaken for actual radio transmission from the plane. Radio waves are inaudible, except after they have gone through a radio receiving apparatus that makes it possible for us to hear them audibly.

L. V. Berkner (left) Chief Operator, and Carl Peterson, Assistant, radio men on Byrd Antarctic Exposition.

In the case of transmitting broadcasts from an airplane, as has been undertaken by station WOR, in New York, a small transmitter is rigged up which is a miniature duplicate of some of the more elaborate commercial installations specially developed for communication purposes. As the flights are to be of short duration, and weight not generally the first consideration, refinements in apparatus can be introduced.

The usual short wave equipment, aerial, and antenna is used, and a regular microphone handled by the trained announcer or reporter assigned to the work. The voice is then picked up on a short wave receiver, carried to the regular broadcasting station by wire, and put on the air in the regular way. The voice is thus heard by the listeners as though the announcer were in the broadcast studio.

* * *

Foreign progress in the development of aircraft radio was revealed at the various radio exhibitions held in Europe. Because of the extensive and almost obligatory use to which radio has been put there, through the high development of passenger carrying lines a great deal of attention is being paid to the design and construction of sets.

One of the most interesting exhibits was shown by Telefunken in Berlin. A transmitter and receiver for radiophone work was shown. It displays the standard means of deriving driving current for the sending set by a wind generator, and by compact storage batteries for the receiver.

The transmitter is hung from stout rubber bands, and is rated at 100 watts. The receiving set is also of conventional design, but constructed largely of aluminum. Aluminum seems, in fact, to be the material most favored by constructors and manufacturers of radio equipment in Germany. A special microphone with a quick listen-talk transfer switch are the features of this airplane radio installation.

Simple Aerodynamics

(*Continued from page* 97)

was 25 inches of mercury, and the temperature was 59° Fahrenheit. What is its elevation?

Twenty-five divided by 29.92 will give us the fraction of standard pressure, in this case, about .835 which is 83½ per cent. Since density is proportional to pressure, find 83½ on Figure 1 (read along line "Density at altitude—per cent of density at sea level"). The altitude corresponding to this density gives us 4,800 feet.

Problems

1—What will be the density of air at a pressure of 22.50 inches of mercury and at a temperature of 10° Fahrenheit? (Use Boyle's Law and Gay Lussac's Law.) Ans., 0.0635.

2—What is the density of standard atmosphere at 10,000 feet? (Use curves of Figure 1.) Ans., 22.

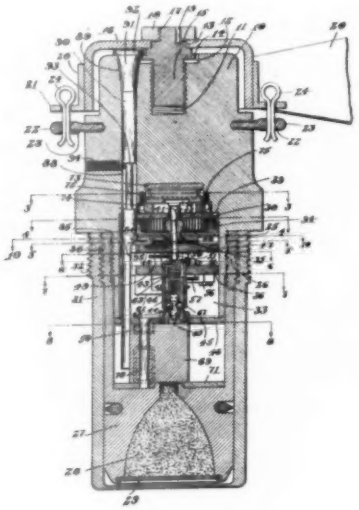
3—An engine develops 225 horsepower at 1,800 r.p.m. at sea level. What power will it develop at 1,800 r.p.m. at 8,000 feet elevation? (Use curve of Figure 2.) Ans., 163+.

Patent Department

The Patent Service of POPULAR AVIATION has been established for the benefit of those readers who wish to keep in touch with the latest mechanical developments. It should be understood that the descriptions given with each patent are taken from the claims made by the inventor and that this publication by POPULAR AVIATION is in no sense an endorsement of these claims, but a record only of the action of the United States Patent Office.

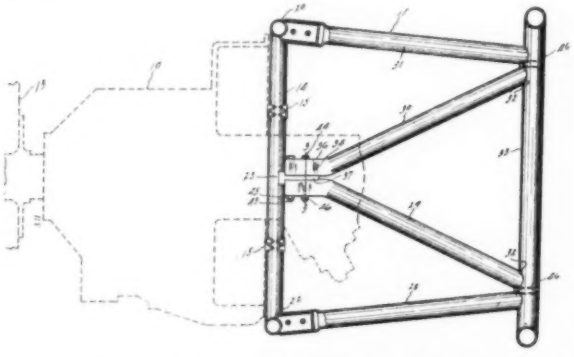
Official Patent Issues of August 21-28, 1928

No. 1,681,390, TIME FUSE FOR AERIAL BOMBS, Patented August 21, 1928, by Frederick W. Bold, of Chelsea, Massachusetts, Assignor to Charles H. Pearson, of Brookline, Massachusetts.



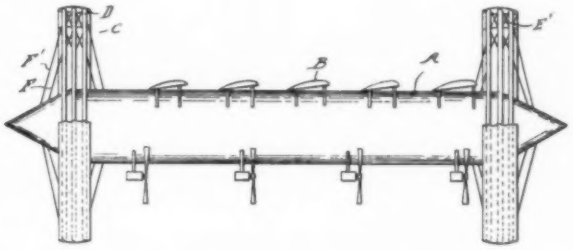
The timing train fuse for detonating the charge of an aerial bomb is positively set in motion by mechanism operated during the flight of the bomb and the improved device is provided with means for absolutely preventing the access of moisture or dirt of any kind to the timing train regardless of the length of time of exposure of such aerial bomb to moisture.

No. 1,681,319, ENGINE MOUNTING, Patented August 21, 1928, by Harold Caminez, of Farmingdale, New York.



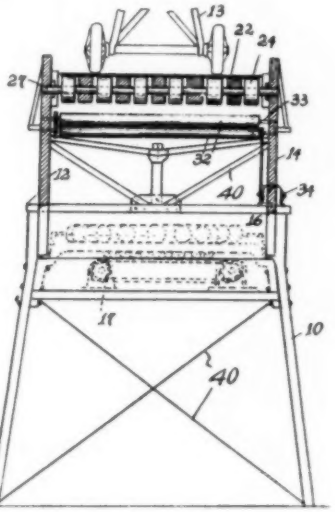
An engine mount having means for definitely fixing the drive shaft of a radial internal combustion engine while permitting vibrations of the engine due to motor torque reactions, these vibrations being absorbed and effectively prevented from being transmitted to the frame by which the engine is supported.

No. 1,681,202, SAFETY APPLIANCE FOR AEROPLANES, Patented August 21, 1928, by Willis C. Ward, of Orchard Lake, Michigan.



The object of this construction is to lessen the destructive effect caused by the impact of a falling plane. A cushioning means surrounds the fuselage, comprising annular inflated tubes and a skeleton framework connecting the tubes with the body of the fuselage.

No. 1,681,474, LAUNCHING AND LANDING PLATFORM, Patented August 21, 1928 by Julius S. Fox, of Cleveland, Ohio.



The treads of this launching and landing platform are constructed of two elements, one of which comprises an endless traveling web whose upper run is normally substantially level with the floor surface of the platform and the other element consists of a series of rotating members mounted transverse of the platform and pivoted thereon but beneath said upper run of the belt or

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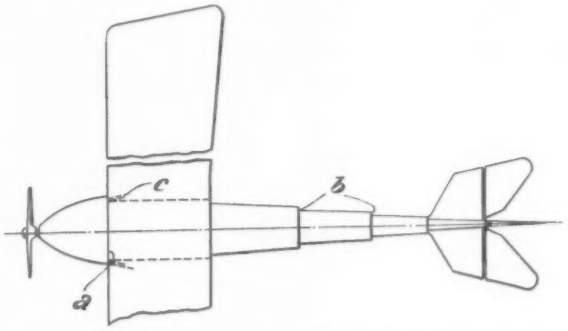
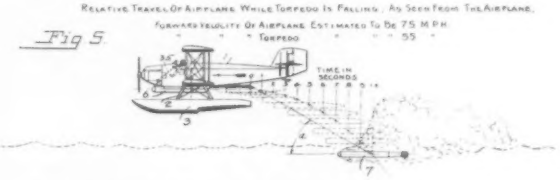
web. The latter serves to provide adequate strength for the tread to bear suitably the weight of the vehicles imposed thereon and the former providing a very uniform tread surface though supported by the rotating members.

No. 1,682,262, BODY STRUCTURE FOR AERIAL AND LAND VEHICLES AND MARINE CRAFT, Patented August 28, 1928, by Ugo Antoni, of Viareggio, Italy.



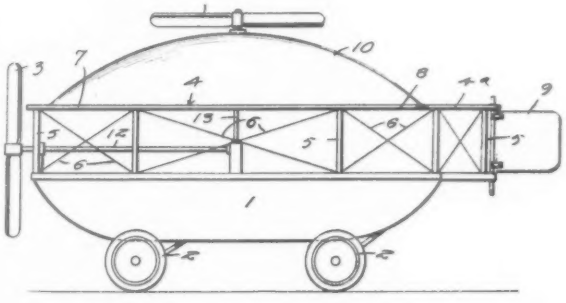
The theory of construction disclosed in this patent is based on the shape of a fish body and claims an aircraft having a body with external offsets defining step-like formation, and flexible plates arranged along the sides of the body.

No. 1,681,434, APPARATUS FOR LAUNCHING TORPEDOES, Patented August 21, 1928, by Holden C. Richardson, of Washington, District of Columbia.



The principal object of this invention is to launch a self-propelled submarine torpedo rearwardly and tail first from the aircraft, thereby retarding the forward velocity of the torpedo and minimizing the flash as it contacts with the surface of the water.

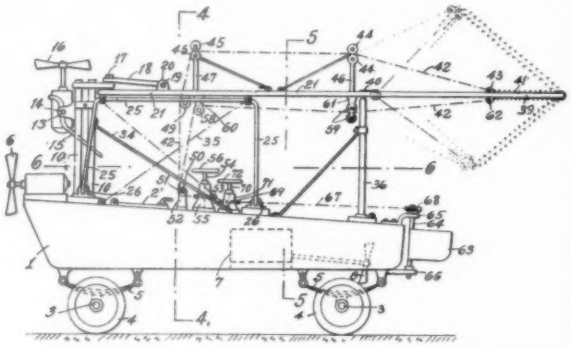
No. 1,681,761, SAFETY AEROPLANE, Patented August 21, 1928, by Harvey D. Blasi, of Detroit, Michigan.



This inventor has in mind an aeroplane construction which will gradually descend in a substantially straight line in the event that its propelling mechanism ceases to function. He employs a plane or wing provided with

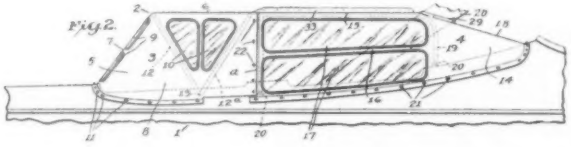
a semi-spherical or substantially semi-spherical hollow portion extending upward from the wings at the center of gravity of the aeroplane and adapted to function as a parachute during the descent of the aeroplane.

No. 1,682,263, AIRCRAFT, Patented August 28, 1928, by José Bilbao, of Habana, Cuba.



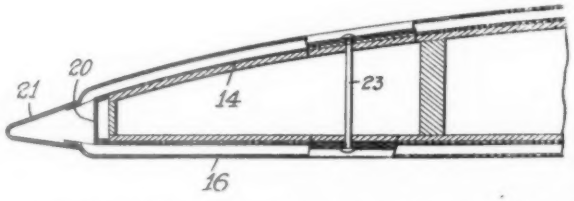
An aircraft of the amphibian variety, having a propeller and its shaft on the rear for propelling the craft as a boat when these become submerged. The invention is provided with a propeller of vertical shaft yet capable of changing its position through an angle of 90 deg., so that it may be used for climbing and coming down directly in the air.

No. 1,682,027, FOLDING TOP FOR FLYING BOATS, Patented August 28, 1928, by Paul G. Zimmermann and Boris V. Korvin-Kroukovsky, of Keyport, New Jersey, Assignors by Mesne Assignments to Healey-Aeromarine Bus Company, Inc., a Corporation of New York.



A closed folding top for flying boats, hydroplanes and the like, particularly designed for covering and enclosing the passenger space of the boat.

No. 1,682,204, AEROPLANE RADIATOR, Patented August 28, 1928, by Wm. Wait, Jr., of Garden City, New York, Assignor by Mesne Assignments to Curtiss Aeroplane and Motor Company, Inc., of Garden City, Long Island, New York, a Corporation of New York.



The object of this invention is the placement of the skin or surface type radiator directly upon the outer covering of the wing framework in such manner that the radiator per se does not under any circumstances constitute a structural part of the wing. Thus organ-

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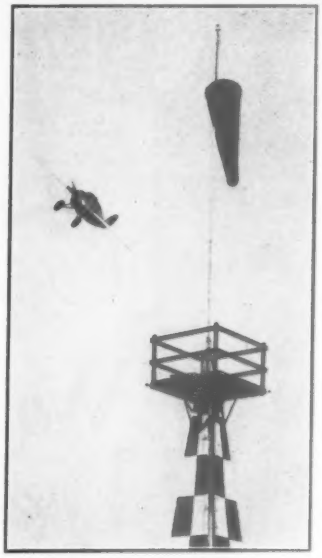

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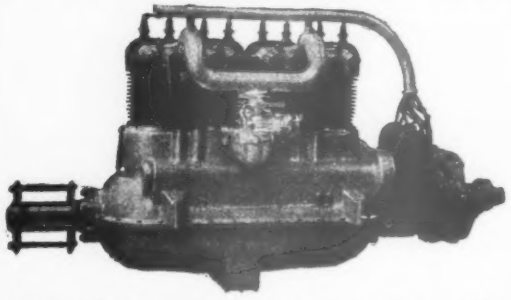

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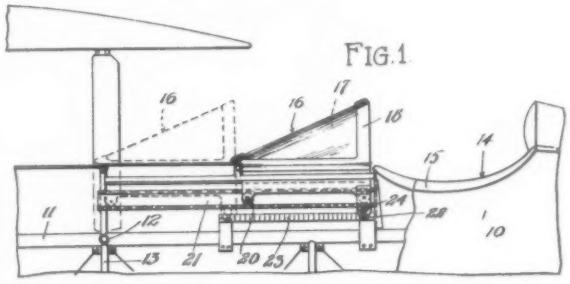
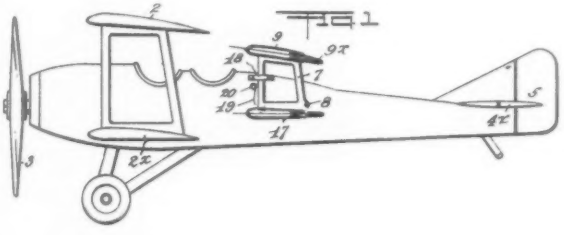
ized, exceedingly light material can be used in the construction of the radiator, since its relation to the wing is such that the operating strains and stresses set up in the wing are kept entirely apart from the radiator disposed thereover.

No. 1,682,229, ADJUSTABLE WINDSHIELD, Patented August 28, 1928, by Temple N. Joyce, of Arnold, Maryland, Assignor to Curtiss Aeroplane & Motor Company, Inc., a Corporation of New York.



A windshield which is adjustable relatively to the aeroplane fuselage or body and which through its adjustment or sliding movement is adapted to vary the size of the cockpit opening. The shield is releasably held against backward sliding movement by suitable mechanical means.

No. 1,681,642, AEROPLANE, Patented August 21, 1928, by Aubrey M. Kennedy, of Los Angeles, California.



An aeroplane comprising a fuselage, propelling and guiding means, a primary wing structure and an auxiliary wing structure smaller than the primary wing structure and mounted at the rear and independently of the latter; said auxiliary wing structure comprising a wing having telescopic sections and means for relatively adjusting said sections.

No. 1,681,562, SAFETY APPARATUS FOR AIRPLANES, Patented August 21, 1928, by William Holmes Wenstrom, of Fort Bliss, Texas.

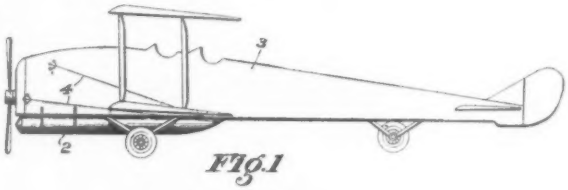
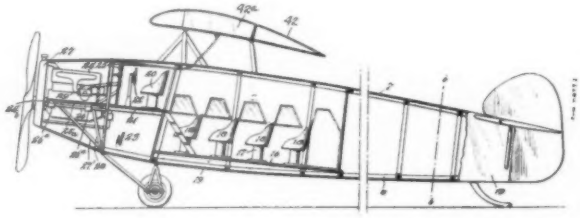


FIG.1

This invention is concerned with the problem of stopping an airplane under emergency conditions. This is accomplished by checking the motion of an airplane

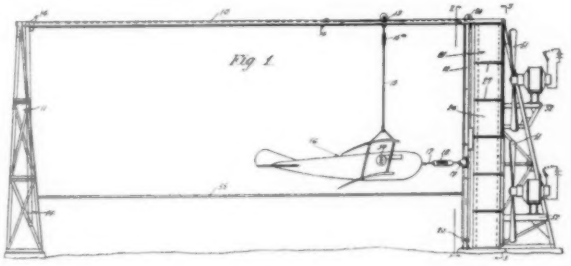
when its speed for any reason becomes a menace to its safety. To accomplish this a tube is placed beneath the forward part of the fuselage and which contains an explosive. When the pilot wishes to check the speed of the airplane suddenly the explosive is ignited and the gases generated in the resulting explosion are directed forwardly, thus producing a backward kick and thereby checking the speed of the airplane.

No. 1,681,331, AIRPLANE, Patented August 21, 1928, by Anthony H. G. Fokker, of Amsterdam, Netherlands, Assignor to Atlantic Aircraft Corporation, a Corporation of New Jersey.



This invention is directed to the provision of an airplane of the monoplane type which may be quickly converted into a biplane. The invention further contemplates a power plant and control unit which may be detached or removed from the fuselage of the airplane with very little effort, so that, when it is necessary to overhaul a motor or engine, it may be quickly taken from its bed and a new engine substituted therefor, so that the plane may be kept in substantially continuous service.

No. 1,682,138, AIRPLANE LABORATORY, Patented August 28, 1928, by Albert A. Merrill, of Pasadena, California.



This invention relates to apparatus adapted for use in connection with various phases of research work in the airplane field, the testing of airplanes prior to being put in service, the training of pilots and recreational pursuits.

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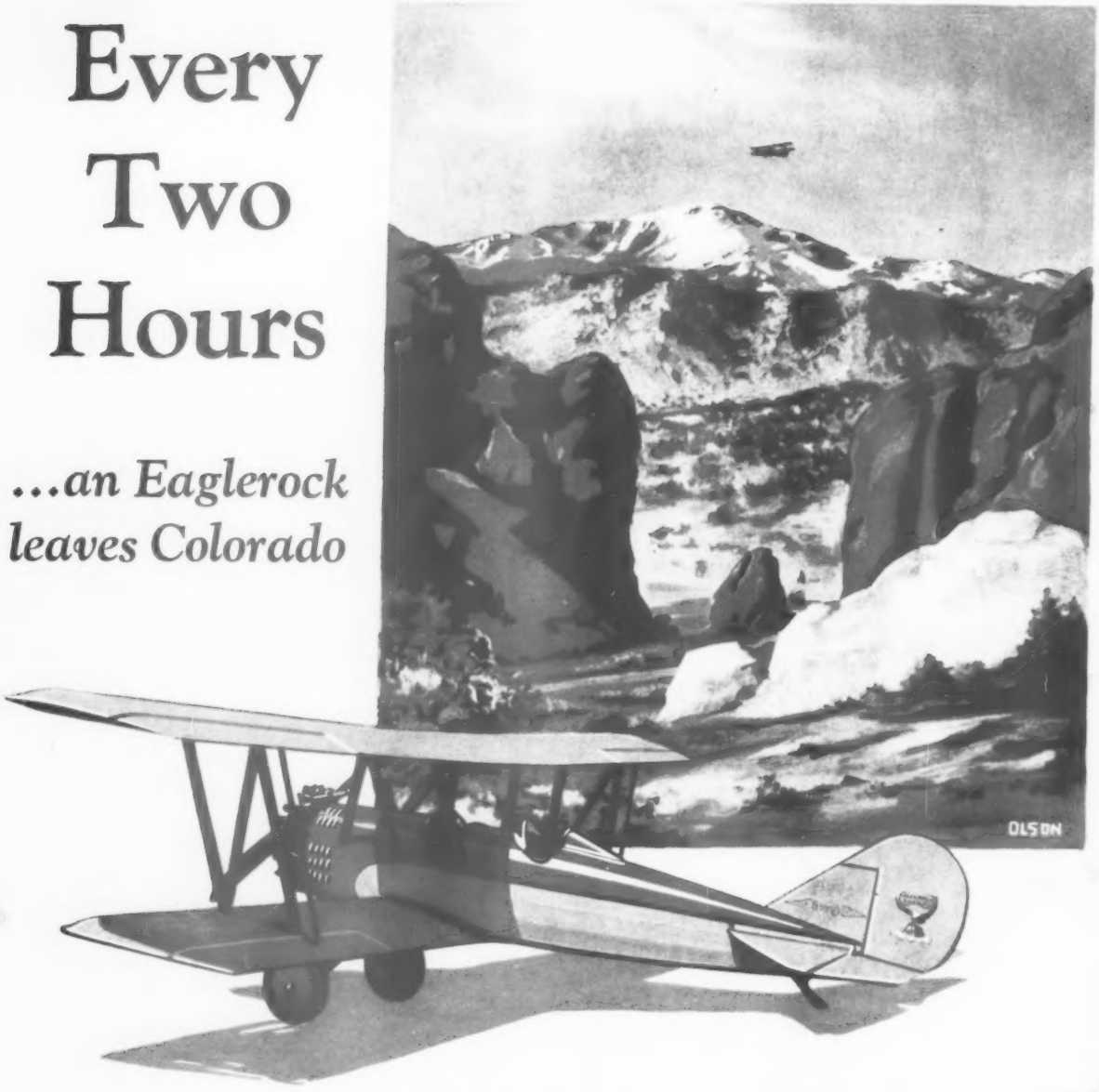

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